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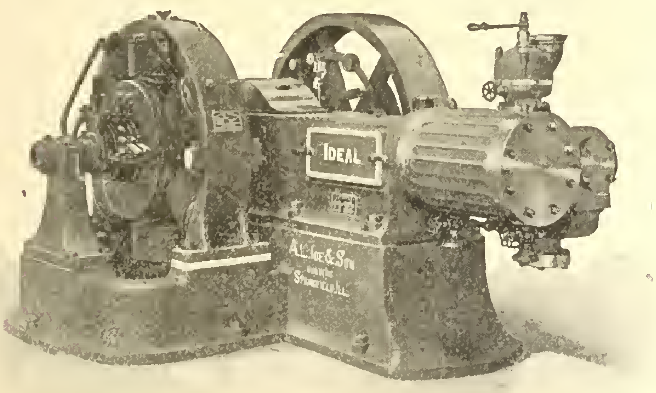

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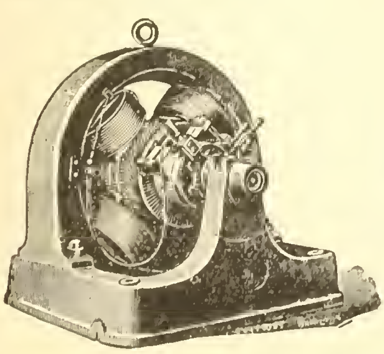

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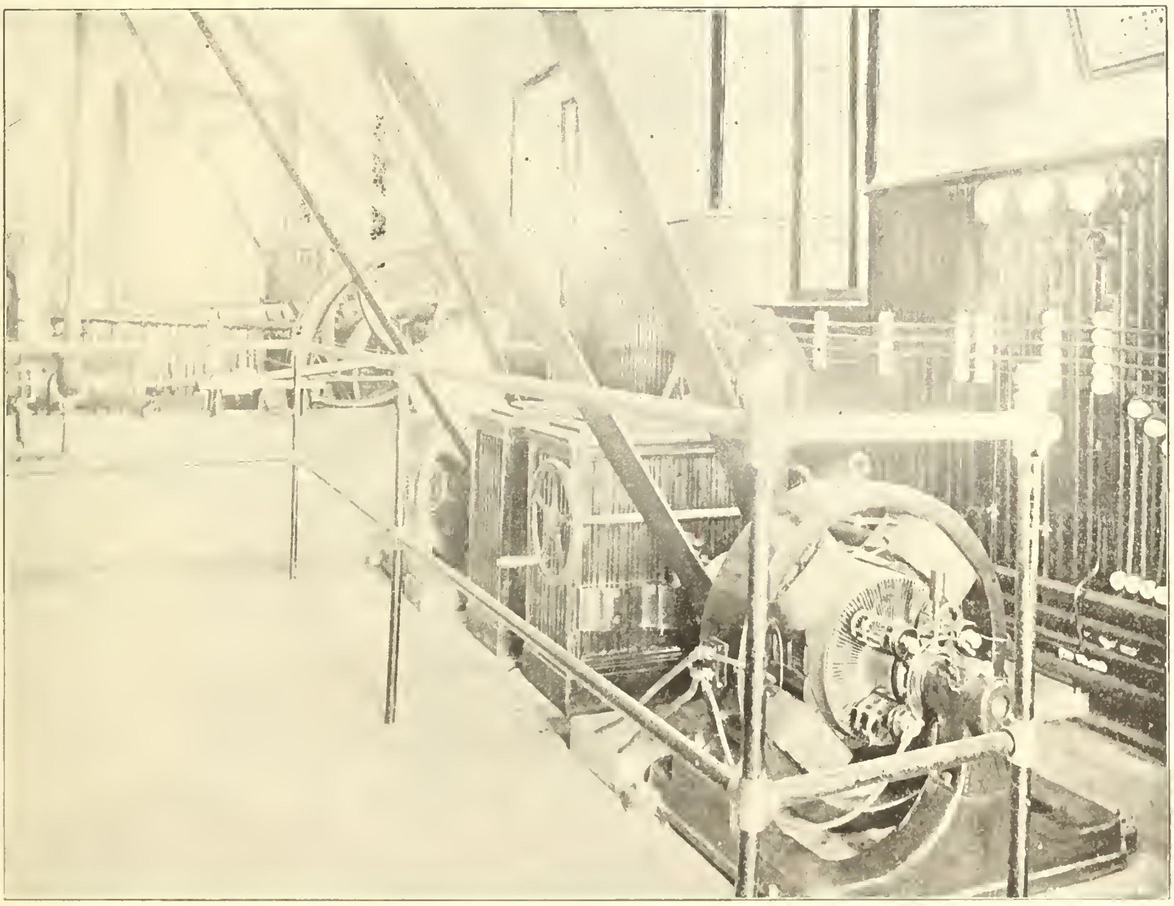
ELECTRICAL PLANT AT THE BEAUPORT INSANE ASYLUM.

Just outside the city of Quebec, at the Beauport Insane Asylum (L'Asile d'alienes de Beauport) an unusually complete electrical plant of small size has recently been installed, a description of which may interest some of our readers. The Beauport Asylum grounds cover an area of about 140 acres, upon which there are fourteen different buildings, eleven of these being supplied with electric light. The boiler house, a part of which forms the dynamo room, is in the centre of the buildings, the most advantageous position.

A noteworthy feature of the installation is the extreme flexibility of the generating plant, which renders the lighting system practically infallible, a point which has very great significance in an institution where lunatics have to be dealt with.

The generating plant is operated by water power, and is in duplicate throughout, with the exception of the steam engine, which is held in reserve as an auxiliary and at the same time is used as a "booster" during the heavy load, the water supply being limited and inadequate for driving the machines under full load. This water power is brought through an underground iron pipe for a distance of four miles, from a large lake which is at an altitude of 300 feet above the grounds upon which the buildings of the institution are located. This pipe is eight inches in diameter for the first two miles and six inches for the remaining distance, and was never intended for any other purpose than an ordinary household water supply, the question of power other than for fire purposes never having been taken into consideration. But upon the advent of the present engineer, he, having had considerable experience in hydraulic work, at once realized the power in store, and in a short time had all the steam power used in the machine shops, laundries, etc., replaced by water power.



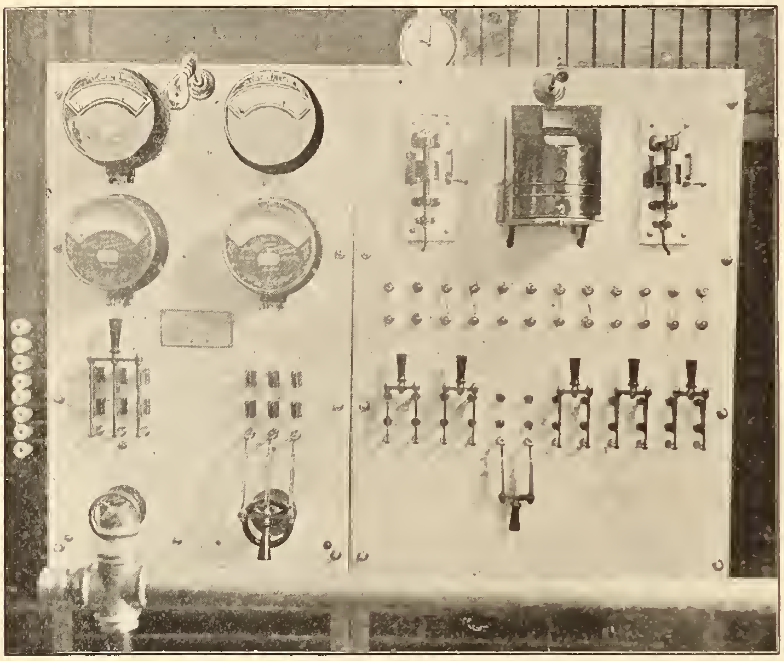
Electrical Plant at the Beauport Insane Asylum—Dynamo Room.

The water wheels are of the Pelton type, designed and built on the premises to suit the local conditions. On account of the success attained with these wheels, the management of the institution was led to ask for an engineer's report on the practicability of utilizing this power to light the various buildings on the grounds with electric light. The coal gas system in use was in need of costly repairs, and was also accompanied by a considerable amount of danger in an institution of this sort.

The illustration on this page is a view of the dynamo room, showing the arrangement of the dynamos, water wheels and the engine. The dynamos are of the slow-

speed Johnson type. The belts going from the pulleys on each machine and the steam engine are connected to the line shaft on the ceiling. As will be seen, the dynamos are directly connected to the shafts of the water-wheels by means of flexible couplers.

Under ordinary conditions it is necessary to run only one machine, but very often it happens that both of them are required. For this purpose, the machines were arranged with equalizer connections brought back onto the middle poles of three-pole main switches, which may be seen on the machine panel of the switchboard, just above the rheostat wheels. The second illustration is of the marble switchboard.



ELECTRIC PLANT AT BEAUPORT INSANE ASYLUM.—SWITCHBOARD.

At all times when the two dynamos are running together, they are belted to the line shaft, which serves as a very simple and reliable regulator as regards the equalizing effect between the two machines. This is the case whether one machine is being run by water and the other by steam, or whether both are being run by water. In the latter case, of course, the engine belt is free. The engine is always ready to run, summer and winter, as the boilers are used to generate the steam for cooking, heating and laundry work.

One water-wheel is provided with a governor, which was also designed and built by the engineer; but this governor is used only during the day when the water pressure is unsteady, on account of the varying loads on other wheels on the premises. At night, when other wheels are not in use, the water pressure is absolutely constant, and once the gate is adjusted for the normal load, it is very little trouble for the attendant to keep the voltage steady. As the load is very near a constant one, the amount of regulation necessary is practically nil. Great pains were taken to make as nearly perfect an installation as was possible, and only the best of apparatus was used throughout, including Weston instruments and T. H. watt-meter.

The circuits are so arranged that should a main fuse blow on any one of them, the fuse terminals may be bridged immediately till the fuse is replaced, unless it is that the mains themselves become short-circuited, which event is highly improbable on account of the substantial character of the outside construction.

The wiring throughout all the buildings is cleat and knob work, with the exception of the main portion of the women's building, which is done in moulding. The whole wiring system is most elaborately laid out as regards the distribution of switches. Each ward is so arranged that one or more lights may be turned on from either end. The completeness of this switch system may be imagined when it is stated that the total number is equal to one switch to every two lamps installed. Leaving out the workshops, stables and laundries, the proportion of switches is equal to every one and one-one-third lamps.

The arrangement of the electric irons in the ironing room of the laundry is shown in the third illustration. In the laundry department there is an equipment of sixteen eight-pound domestic irons of the American Heating Corporation's make, and it is claimed that about twice as much work is accomplished daily since the adoption of this system.

ELECTRIC PLANT AT BEAUPORT INSANE ASYLUM.—IRONING ROOM IN LAUNDRY.

The chapel after illumination is an exceedingly pretty and artistic feature of this installation. For this purpose 13 volt miniature series lamps are used in many colors, and the rich effect they give when lighted is one not easily forgotten.

In the spring this plant is to be made even more com-

plete by the addition of quite a large storage battery to carry the night load and to take the place of the second machine and engine during the heavy load.

The entire plant as above described was contracted for and installed by Mr. Edward Slade, of Quebec, upon whom it reflects much credit. It is one of the most interesting small installations yet carried out.

QUESTIONS AND ANSWERS.

"SUBSCRIBER" writes: "I am in charge of an alternator stamped by its makers 40 amperes, 1,040 volts. As I understand it, one ampere on primaries gives 20 amperes on secondaries; if so, 20 × 40 = 800 amperes, total secondary capacity. Now, some electricians calculate on 104 volts, ½ ampere per lamp, others 6 amperes to 10 lamps. The one would give 1,600 lamps, the other 1,440 lamps capacity. This must be wrong, for the manufacturers only claim 800 16 c.p. lamps as the total capacity of the machine. Will you kindly give me the proper system of figuring out a machine's capacity, also what size of wire should be used for primaries, it being 1,500 feet from machine to centre of distribution? Our transformers are banked in pairs, operating on a three-wire secondary system. What size of wire should be used to give the highest efficiency?"

ANSWER.—You are making a serious error in your method of calculating the machine capacity. If you desire 20 amperes on the secondary for each ampere on the primary, you must have a "transforming ratio" of 20 to 1. This will give you 52 volts secondary pressure. If, on the other hand, you desire 104 volts secondary pressure, your transforming ratio must be 10 to 1, in which case you will have only 400 amperes on the secondaries, not 800; so that you will see that in your calculation you are multiplying a 20 to 1 ratio amperage by a 10 to 1 ratio voltage, thus getting, of course, a very wrong result. Whether you get 20 secondary amperes to every primary single ampere or not is a matter that depends on your transformers. It is not usual to-day to use 52-volt lamps; therefore, assuming you use 104-volt lamps, and have therefore 104-volt secondaries, with a transforming ratio of 10 to 1, the method of calculating your machine capacity is as follows: The primary capacity is, of course, 40 × 1,040 = 41,600 watts. The secondary capacity, as you probably know, is the same number of watts, but with different volts and amperes. Using 104-volt secondaries, divide 41,600 by 104, and the quotient 400 is the total secondary amperage (because 104 × 400 = 41,600 watts). How many lamps this 400 amperes will allow depends on the kind of lamp. You are aware that you can purchase in the market lamps requiring 3, 3½ or 4 watts per candle power, or per 16 c.p. lamp requiring 48, 56, or 64 watts. Probably the 3½ 56-watt lamp is what you use. This lamp takes 56 ÷ 104 amperes, or .538 amperes. The total number of lamps that the machine will supply can therefore be calculated by dividing 400 by .538, with the result 743 lamps. A 4 64-watt lamp would similarly require 64 ÷ 104 = .615 ampere, giving 400 ÷ .615 = 652 lamps. And again, similarly, a 3 48-watt lamp would require 48 ÷ 104 = .461 ampere, giving a total capacity of 400 ÷ .461 = 867 lamps. The foregoing gives the method of calculation in unnecessary detail, for the sake of explanation. The shortest method is: A machine with the primary voltage and amperage 1,040 and 40, has a capacity of 41,600 watts. The capacity of this in 56-watt lamps is evidently 41,600 ÷ 56 = 741 lamps. The size of primary wire to use is found by the formula,

$$\frac{21 \times 1{,}500 \times 40}{\text{volts in ``drop''}}$$

Allowing 5% drop, or 52 volts, the wire is calculated at 24,231 c. m. = No. 6 B. & S. The proper size of wire for secondaries depends on the distance apart of transformers, but probably three No. 6 secondaries would be the best.

"J. M.," Toronto, writes: "I have read with interest your article in the November issue on the transmission to Arthur, Ont. As I, in common with a great many others of your readers, am interested in prospective transmissions, I would take it as a great favor if you would publish a full description of the plant; give length of line, size of wire, number of wires, voltage of transmission; state whether it is single or two phase, number of lights supplied, and the formulae by which the 6% loss was obtained."

ANSWER: The Grand Valley-Arthur transmission plant, referred to by our correspondent, has been in operation for some time. The plant is located at Grand Valley, and consists of a 75 h.p. high speed engine, maufactured by the Goldie-McCulloch Co., of Galt, and an 85 h.p. boiler. Fuel used is mill refuse and slabs. The electrical equipment was furnished throughout by the Royal Electric Co., and consists of a type R "S.K.C." two phase generator, with the the usual station instruments, mounted on a marble switchboard. One phase of the generator supplies incandescent street and house lights for the village of Grand Valley, to the number of about 350, and is distributed in the ordinary way, the primary voltage being 2,080 volts and the secondary 104 volts. The second phase of the machine is carried to the switchboard in the usual way. After passing through the switchboard, it enters a booster transformer, which has a range of 300 volts. This is sufficient to overcome the ohmic loss in the transmission of 9 amperes at 2,400 volts a distance of 13 miles, where it reaches the village of Arthur, and is there distributed in the usual way, 2,080 volts primary and 104 volts secondary. There are also operated at Arthur from this circuit three alternating current arc lamps of a nominal 2,000 candle power, and 15 32 c.p. street lamps, the balance being used up in store and house lighting. The regulation of the lights at Arthur is accomplished from Grand Valley by a regulator head set in the booster transformer, where the primary voltage can be regulated at 20 volts per step, or one volt in the secondary. There is also a telephone line erected on the transmission line, and if the light varies or the voltage raises or drops, the man in charge at Arthur immediately notifies the engineer at Grand Valley. Thus the pressure is kept practically constant. The heart of the entire system is, of course, the transmission line. Special care was taken in the construction of this line. The poles vary from 30 to 35 feet in length, with not smaller than 7 inch tops, set 5 feet in the ground, thoroughly tamped and properly guyed. Running through an open country as this line does, it is subject to severe lightning storms. It was, therefore, very essential that lightning should be guarded against. In constructing the line there was put underneath every fifth pole an iron plate one foot square, No. 16 Birmingham gauge. To this was attached a galvanized iron wire run to the top of the pole and there attached to a barbed wire, which is strung along the entire line on top of the poles, and which is also grounded at each end of the line. This protection has proven sufficient, as it passed through two very severe lightning storms late last fall without any damage. The cross-arms are made of seasoned pine fastened to the pole with two 7 inch lag screws. The pins are of the best white oak, and the insulators triple-petticoat glass. The transmission line consists of two No. 4 bare copper wires, which are fastened to the insulators in the usual way, with a side tie. Beneath this cross-arm is affixed a second one, which carries the telephone wires. The telephone line is constructed in the ordinary way, with the exception that it is transposed every fifth pole, or every 500 feet, to overcome the induction due to alternating current. This it does entirely, as the telephones are in use daily, and conversation can be carried on in an ordinary tone when the transmission line is carrying its full complement of current. That the above is a successful venture is evidenced by the fact that the proprietor of the plant is negotiating for a machine of a larger size, or one having a capacity of 1,000 lights.

The Leamington Electric Light Company, of Leamington, Ont., will increase its capital stock from $3,000 to $30,000.

The Board of Trade of Parry Sound, Ont., has recommended the construction of an electric railway to connect Parry Sound and Depot Harbor. The cost of the road is estimated at $25,000.

The Gurney Tilden Co., of Hamilton, are now operating their entire works by electric power. They have installed two 20-h.p. and one 30-h.p. S.K.C. two-phase motors, and get their current from the Cataract Power Co.

The gas and electric light works at St. Hyacinthe, Que., were badly damaged by fire on the 5th inst. The buildings, including engines and dynamos, were almost completely destroyed. The loss is estimated at $10,000, which is believed to be fully covered by insurance. The works are owned by Mr. Louis Brousseau.

The Hamilton Electric Light and Power Co. are installing in their lighting station two 240 k.w. S.K.C. synchronous motors. These are to drive the shafting from which is operated the arc machines and the motor power service. The current for these motors is to be supplied by the Cataract Power Co. It is expected that the steam plant will be entirely shut down by the first of February. The incandescent light has been furnished from the Cataract Power Co's current for the past three months, and has been very satisfactory.

EFFECTS OF THE RECENT STORM AT HAMILTON.

After the experience through which they have recently passed, the citizens of Hamilton should be able to appreciate, at something like their true value, the advantages conferred by the modern street railway, electric light, telegraph and telephone systems. The unusually destructive snow and sleet storm which passed over that city in December completely demoralized for a time all these electrical agencies. The accompanying illustration will show even better than a lengthy description the chaotic condition which the electrical companies were called upon to face in Hamilton and throughout the western peninsula. The transmission lines between Hamilton and Niagara and west to Sarnia and Windsor were badly crippled. One of the telegraph officials applied a rule to a No. 8 fallen wire at Burlington and found the diameter, inclusive of the coating of ice, to be 4½ inches, and the weight about 8 lbs. to the foot. It was impossible that even the best constructed lines could withstand such a burden, so that in the sections where the storm raged most severly there was a total collapse. Mr. A. B. Smith, superintendent of construction, and Mr. C. P. Dwight, of the G. N. W. Telegraph Co., Mr. L. B. McFarlane, superintendent of the Bell Telephone Co., and Mr. Homer Pringle, division superintendent of the C.P.R. Telegraph Co., were early on the scene with a large corps of linemen summoned from various directions. As soon as possibie temporary lines of communication were strung, to serve until a permanent restoration of the lines could be effected. This will involve much time and an expenditure running high up into the thousands.

View on Hughson Street, Hamilton, Showing Effect of the Recent Sleet Storm.

ELECTRIC LIGHT AND POWER INSTALLATION.

What is doubtless one of the most complete and conveniently arranged electric plants operated by water power has recently been put in operation at Sherbrooke, Que., by the Sherbrooke Gas & Water Company. The new plant was designed to largely augment their facilities for supplying electric light and power, there being an increasing business in sight, one contract, for example, being the electrical driving of the machinery in the new shops of the Quebec Central Railway in Newington. During last fall their water power was re-developed, the two Leffel vertical wheels being replaced by two 40-inch horizontally set Crocker turbines, and their lighting machines by two 300 k.w. S.K.C. Royal Electric generators, these being belted direct to the water wheel shaft, and the consequent loss by gearing and jack shaft transmission obviated. The company's station, so prettily situated on the rocky little island, has been enlarged and improved. The imposing marble switchboard, the large and nicely finished generators on the main floor, with elbow opening off containing the wheel case and pulleys, within the light and roomy station building, give evidence of the company's determination to be in the front rank in these days of improvement, and reflect great credit on Mr. Sangster, their able and efficient superintendent.

The construction and installation of the water power machinery as a whole was placed in the hands of the Jenckes Machine Co., of Sherebrooke, and the finished work reveals an excellent example of progressive ideas and good workmanship. Two 40-inch Crocker turbines in horizontal setting are contained in one steel case, 10 feet in diameter and over 20 feet in length, and are

supplied with water under 31 feet head from the dam some 70 feet away, by two feeder pipes, 80 inches in diameter. Each wheel will develop 518 horse power. The whole wheel case and shafting is supported by steel girders and solid masonry. All bearings are of the self-oiling ring type, and the gate mechanism is operated from a suitable point in the dynamo room overhead. The main driving pulleys located at each end of the wheel case are 108 in. diameter and 36 in. face. The weight of the entire plant is about 125,000 lbs.

Taken altogether, the starting up of this plant marks an important point in Sherbrooke's industrial history, and emphasizes the ability and energy of those concerned.

ELECTRICAL STAGE APPLIANCES.

The proposed application of electrical power for mounting plays at Drury Lane, on the lines advocated by Mr. Edwin O. Sachs, has now taken a tangible form in the completion of the first section of the stage installation in time for the impending pantomime.

Mr. Sachs' present work refers principally to the stage floor and its movability in sections above and below the footlights. The total area now already movable by mechanical power exceeds 1200 square feet.

The electrical appliances just completed take the form of so-called 'bridges,' each working independently. Each individual section measures 40 feet by 7 feet, and weighs about 6 tons, of which about 4 tons are counter-balanced. They can travel about 20 feet vertically.

The motive power is from the ordinary electric supply mains over a four-pole motor, developing 7½ h.p. at 520 revolutions per minute. The 'bridges' are suspended from cables, and these, working over the motor, allow the former to be raised with the necessary live load at rates varying from 6 feet to 20 feet per minute.

Mr. Sachs has arranged for every possible safeguard against accident, the 'bridges' themselves being so constructed that in the event of derangement of current the appliances can be worked by hand gear. Automatic switches are provided so as not to be entirely dependent on the attendants, and automatic catches will work in case of rope-breaking. Special locking gear has been installed to hold the bridges stationary at certain points, such as stage level, and a very large factor of safety has been allowed in apportioning the strengths and weights in the various parts of the mechanism, having special regard to the ever-increasing scenic requirement under Mr. Arthur Collins' able management.

As regards the economic aspect of the electrical installation, the initial outlay on Mr. Sachs' system is about half that of Continental hydraulic work, and this is allowing for English contractors as against foreigners. The maintenance is minimal, whilst the actual working only costs a few pence per performance. The saving in manual labor on the stage is very considerable, whilst the hygiene of the theatre is materially raised by the absence of woodwork.

The Dominion Bridge Company, Montreal, have just completed the installation of an arc lighting system in their large works at Lachine. The dynamo and arc lamps were manufactured by the W. A. Johnson Electric Company, of Toronto.

It is learned that the new electric railway in Kingston, Jamaica, which is being built by Montreal capitalists, is nearing completion. A fortnight ago a trial trip was made, under the direction of Mr. Henry Holgate, superintendent for the West India Electric Co. The speed of the car was about nine miles per hour.

GOOD ADVICE TO BOILER ATTENDANTS.

The Manchester, Eng., Steam Users' Association has issued the following hints to boiler attendants :

Water Level.—Before lighting fires see that there is sufficient water in the boiler. Test the water gauges frequently and keep the water level steady.

Blow-Off Cocks.—Before lighting fires be sure that the blow-off cocks are closed and not leaking. Occasionally feel if the blow-off waste pipes are hot. Blow off from bottom before starting the engine. Sediment has then settled in the elbow pipe. Blow off the scum before stopping the engines, but only when the water level is at the correct height. At such times most of the scum has collected in the troughs.

Lighting Fires.—Sudden changes of temperature may produce fractures or start leakages. Therefore never raise steam hurriedly. The top and bottom of a boiler should grow warm together. If convenient, fill the boiler with warm water through the economizer. If the boiler water is cold, allow fully six hours for raising steam. If pressed for time, fill the boiler to the top of the water gauge, fire slowly, and keep the safety valve open until steam blows off freely. After closing the safety valve, blow out the bottom cold water till the working level is reached. The pressure may now be raised more quickly.

Smoke Prevention.—Smoke and imperfect combustion are caused by an insufficient air supply or by premature cooling of the flames. Therefore after coaling, when the fires are black, admit air either at the door or through the split bridge. It is less wasteful to admit too much air than too little. With smoky boilers or when hard pressed, keep the fires thin and even. Fire steadily. Don't coal all furnaces at once. Coal each furnace on one side at a time.

Emptying Boilers.—Do not empty boiler while steam is up.

Overhauling, Cleaning and Inspection.—Clean the boiler monthly or oftener ; remove the scale while soft, if possible while emptying the boiler. Sweep the soot off the boiler plates and clean the flues every three months, as well as on the occasion of the annual inspection. All leakages should be stopped, any cause of dampness in the setting should be removed, corrosion should be arrested. The fusible plugs should be cleaned on the fire side and water side once a month, and the fusible metal should be renewed once a year at the time of the annual inspection. All cocks should be kept oiled, and, unless asbestos-packed, they should be overhauled once every month. These cocks, the feed valves, steam stop valves, and all safety valves, should be overhauled annually on the occasion of the inspector's visit.

Manholes.—Before opening the man-holes, ease the safety valve so as to be quite sure that there is no pressure in the boiler. Before entering a boiler secure the steam valves and blow off cocks.

Safety Valves and Low Water Alarms.—Never overload or tamper with safety valves or with low water alarms. Ease or test them regularly every day. Be sure that they are in working order. If they will not work properly, reduce the steam pressure and then report to the manager.

Mr. E. O. Champagne, boiler inspector for the city of Montreal, has given public notice that steam users neglecting to provide smoke consuming apparatus will be prosecuted.

MONTREAL.

(Correspondence of THE CANADIAN ELECTRICAL NEWS.)

VISIT TO THE CANADIAN GENERAL ELECTRIC COMPANY'S WORKS.

As briefly mentioned in this correspondence last month, a visit of inspection was made on December 2nd, by members of the Faculty, Professor Owen, and the advanced students of the Electrical Department of McGill University, to the works of the Canadian General Electric Company at Peterboro', Ont. The party left Montreal the previous evening in a special car on the C.P.R., the car being side-tracked on its arrival at Peterboro'. The company consisted of Dean Bovey, Professors R. B. Owens (head of the Electrical Department), J. Wallace Walker, R. J. Durley, John Bell, E. Rutherford, H. Jacquays, Mr. F. R. Redpath, and the following students: Messrs. J. A. Shaw, R. E. Burgess, E. P. Featherstonhaugh, E. M. Archibald, L. Denis, L. L. Gisborne, J. C. Hyde, A. T. Grier, R. M. Wilson, H. M. Ewan, John S. Whyte, E. S. Wenger, J. W. Fraser, H. Meredith Percy, F. W. Walker, J. F. Weller, J. E. Glassco, and W. B. McLean.

These gentlemen were met on their arrival by Mr. Stephens, superintendent of the works, Mr. Watts, and other officers of the Canadian General Electric Company, who took them in charge as the guests of the company and extended to them every courtesy and hospitality during their visit.

The greater part of the day was spent in making a close examination of the manufacturing methods employed in the various departments of the works. For this purpose the visitors were divided into four groups, each group being in charge of one of the company's engineers. The meter department was first visited, where opportunity was given of witnessing the construction of the Thomson recording watt meter. Following this came an inspection of the transformer department, where the T. & H. type of transformers was seen in process of manufacture; next the department in which all kinds of fittings, such as sockets, rosettes, small switches, cut-outs, etc., are made. In the brass department the workmen were engaged on the manufacture of switchboards, including a 19-panel board for Winnipeg, designed to handle the complete electrical output of that city, including street railway, lighting and power circuits. There was also to be seen under construction in this department high tension switchboards, including a 4,400-volt board for Napanee.

All the above-mentioned departments are situated in the gallery of the main workshop. Downstairs are the armature department, test department, machine shop, tool room and commutator department. Almost every available foot of space on this floor was taken up with various classes of machinery in process of manufacture, prominent among which was to be seen a 300 k.w. single-phase rotating field alternator for the London Electric Company, a 300 k.w. monocyclic direct connected alternator for Winnipeg, several large synchronous motors for the mining districts, and a number of large induction motors for the Montreal Cotton Company, of Valleyfield, consisting of one 200 k.w., one 150 k.w., four 100 k.w., one 75 k.w. and one 250 k.w. machine; also a 475 k.w. six-pole lighting generator for the Toronto Electric Light Company.

No. 2 building, which was next visited, contains the pattern and carpenter shop, the drying ovens, and in the rear the brass foundry and compound pots for compounding wire.

In the adjoining building is the wire department, where the insulation of various kinds of wire is put on. In the upper part of the building is installed machinery for covering the finer grades of wire and for the manufacture of small armature coils, which are sent to the armature department to be assembled on the bodies. At the rear of the upper part of this building is located the incandescent lamp manufacturing department, which is perhaps the most interesting of all to the student, partly on account of the fact that the process of manufacture has in the past been more carefully guarded than in the case of many other kinds of apparatus, and also because of the many delicate and interesting operations through which the lamp passes in the process of manufacture. This department of the General Electric Company's works is in charge of Mr. Burnett, who took pains to explain as thoroughly as possible to the visitors the numerous details of the manufacturing operations. The work in this department is largely performed by young women, who are residents of the town and have been here trained to the work, which, by the way, requires no small amount of skill. The output of this department is understood to be about 1,500 lamps per day. It was interesting to learn something about the nature of the glass which is so important a material in this branch of manufacture. The visitors were informed that a great many varieties of lead glass had been experimented with, and that so great is the variation in quality that a difference of 50 per cent. in breakage has resulted from the use of different brands. It will thus be seen that the first cost of the material becomes a secondary consideration, as glass which can be purchased at a low price may in the end prove to be the most expensive, owing to its brittleness. The filament, which is so important a feature of the lamp, is in its original form a paste, which is drawn out to the required size and hardens, after which it is vulcanized and covered with a deposit of carbon. This filament is fed through a machine set to gauge, by which it is cut into proper lengths for lamps of various candle powers. The glass bulbs come from Cleveland. Among the more delicate operations connected with the manufacture of the lamps may be mentioned, the fusing of the leading-in wires into glass mounts, the making of the carbon joint between the filament and the leading-in wires, the flanging of the neck of the lamp, the inserting of the mount and filament into the bulb, and the closing up of the neck of the lamp by the fusing together of the bulb and mount. The air is afterwards extracted from the bulb and the lamp sealed up at the bottom. After this operation the lamps go into the testing department, where the vacuum and lighting qualities are tried, each lamp being compared as to its light-giving power with a standard lamp.

The visitors were also shown through the carbon and porcelain works, which occupy a separate building and embrace many interesting processes.

In the evening they were entertained at the residence of Mr. Stephens, and courtesies were likewise extended to them by Mr. Davis, the Mayor of the town.

The following morning they were driven to the Trent Valley Canal, where an inspection was made of the locks and other engineering features of the work, after which they returned to Montreal, not, however, without first having given full expression to their earnest appreciation of the kindness of the Canadian General Electric Company in affording them the opportunity of gaining much valuable information, as well as in looking so well after their comfort during their visit.

A CHARMED LIFE.

During the recent disastrous fire, one of the walls of Greenshield's warehouses toppled over into Craig street, carrying with it a great mass of electric wires and cables, the property of the electric light, telegraph and telephone companies. A day or two afterwards a gang of G.N.W. linemen, among whom was one Pierre Brouillet, were engaged in repairing the damage. Pierre was at the top of a 40-foot pole, when he fell limp across the cross arm, with his hands grasping the iron wires. His companions, with the aid of a couple of firemen, lowered the unconscious man to the ground, and the ambulance hurried him to the hospital, where, much to everybody's surprise, he soon recovered consciousness, and a few hours later walked into the head office of the company and reported for duty. It is not true, as stated in the local papers, that a current of 2,500 volts passed through Pierre's body, as the wire with which he came in contact was not capable of carrying that amount of current. For the same reason it would not be wise to bank on the conclusion that the man who gets in the path of a 2,500-volt current will escape with nothing more serious than a bad shaking up. The victim of this accident has escaped death so many times that he is regarded as the possessor of a charmed life. It is recalled that he fell into the Chambly Canal, but was fished out; that a hoist on which he was standing dropped four storeys without killing him, and that he also escaped death in a fire which destroyed the lives of two of his children.

MCGILL UNIVERSITY NEWS.

Professor R. B. Owens has just returned from a trip to New York and Baltimore.

The apparatus for the new equipment of the Electrical Engineering Department is being received and put in place.

Mr. Samuel Insull, president of the Chicago Edison Co., is to lecture at McGill University during the latter part of February.

Dr. A. E. Kennelly, now of Philadelphia, and president of the American Institute of Electrical Engineers, but for a long time engaged in submarine cable work, will give four lectures on Submarine Telegraphy at McGill University about the end of January. All engineers interested are invited to attend.

NOTES.

Winter trolley parties have been introduced over the Montreal Belt Line, to Hotel Bout de l'Isle.

Mr. Normington, late of the G. N. W. Telegraph Co., this city, now with the W.U. Telegraph Co., New York, spent his vacation in Montreal. Mr. Normington was on the U. S. Signal Corps during the late unpleasantness between the United States and Spain, being stationed at Chickamauga Park.

Trade in Montreal during the fall and holiday season has been on the whole good, and there are few, if any, complaints from either the construction or supply houses. The outlook for construction after January, however, is not bright, and the supply men will be correspondingly affected.

It is with pleasure that your correspondent learns of the retention by the Canadian Pacific Railway Co. of Mr. R. A. Ross as their consulting electrical engineer. Mr. Ross is one of the few who can be depended on to act strictly in the interests of his employer and give all contractors equal opportunities in tendering. His previous experience with the General Electric Company and the Royal Electric Company would seem to serve him to good purpose in his present position with the C.P.R.

A certain up-town dry goods store has a very tasty display of table napkins and doylies forming a miniature ice palace, somewhat similar to the genuine palace we had in the good old times. The window dresser, however, can safely offer his thanks to electricity, for without its aid in illuminating the stained glass windows, the effect would be much less attractive. Various other stores display revolving turn-tables, may-poles, etc., in motion, run by motors.

If the miscreant is caught who threw the iron hoop over the transmission wires of the Lachine Rapids Company, thereby making a dead short-circuit and blowing the fuse at the generator, it will be made pretty warm for him. It was evidently the work of some one who knew something more about electricity than the average layman does, but one who, on the other hand, did not pause to think that there might be an employee a few feet in front of said fuse when it blew (as was the case) and who miraculously escaped a bad burn. A fuse blowing on a large generator under a pressure of 4,000 volts is not a pleasant thing to be near, to say the least.

The Eagle Knitting Mills Co., of Hamilton, have installed in their factory a 30 h.p. "S.K.C." two-phase induction motor, which drives their knitting machinery and has replaced their steam plant.

RATE SCHEDULES AND DIVIDENDS.

By "Economy."

Most electrical journals devote a considerable amount of space to papers by well known authorities, dealing principally with the financial side of electric lighting and power service, pointing out how expenses can be diminished and incomes increased. The authors seem to be mostly connected with very large plants, and their proposals and expedients, while theoretically sound, apply only to such large enterprises. Instead of any further trying to cut down the cost of production per k.w. in the generating plant, or of insisting upon a still higher efficiency in all parts of the producing or transmitting system, the electrical fraternity is turning its attention to the establishment of a proper basis for the formulation of rate schedules, having been forced to the conclusion that a uniform rate for all classes of customers, whether by meter or month, is not only unscientific, but actually results in selling electricity to some for less than the cost of production, while other consumers who should be encouraged pay for more than they should. Although the conditions governing the operation of large and small plants are so dissimilar that the adoption of a certain policy may be beneficial for the one, while suicidal for the other, still there are always certain broad, general principles upon which every successful business must be conducted, and which, underlying as they do the business of electric lighting, will apply to some extent to all sizes of plants.

In order that a plant may be a profitable investment, the operating expenses must be as low as possible; the business must be pushed for all it is worth, and losses must be reduced to a minimum. The various expedients for effecting economies in the power house, condensers, heaters, etc., are beyond the scope of this article, and it is assumed that everything has been done in this direction that skill and experience can effect. If without increasing the investment, the business and therefore the income can be increased, the result will evidently be in the nature of a larger dividend. If the total load is not as great as the capacity of the power house, then a vigorous canvass is the first means that would occur to everyone. But in the medium-sized provincial town, which is the condition more particularly investigated in this article, the possible business with the average rates charged has distinctly a clear limit. There is no day business such as is found in cities—in cellars, vaults, restaurants, etc. The business done is principally with stores, hotels, a few private houses, and the churches. A considerable proportion of the population of every medium and small town lives in quite small houses, and is usually considered useless for electric lighting purposes; but if they could be brought in by any means, it might be good business, even if a slightly increased investment were required. Using 10 c.p. lamps generally has a good effect in this direction. But in many cases, a general all-round reduction of rates by a small percentage is counterbalanced by an increase of business, which is of itself advantageous in improving the load and therefore raising the efficiency of operation. A considerable class of possible consumers would no doubt be attracted by proposals based on the shutting off of their lights at 10 o'clock. A 10 c.p. lamp on a 10 o'clock circuit would probably pay the power house a satisfactory sum, while offering great attractions to persons who are not willing to pay a larger rent for a lamp on the chance of wanting it to burn all night—or at odd times during the night. It is a very simple matter to calculate what it actually costs the central station to produce the energy for such a lamp, taking account of all fixed and variable expenses; the possible renting price will be found within the means of very small householders. The probabilities are that in such a case a separate circuit would be required, but only a secondary circuit, and the same transformers might by suitable arrangements be made to cover the increased service.

For stores, alternating long-burning arcs may be used when the space is free from hangings. Where, however, the full capacity of the power house is already rented, the only methods available for increasing business are either to reduce the number of less profitable lamps and cater only to the most profitable business, or to use lamps of the highest efficiency obtainable. Unfortunately, the latter course is possible only at the expense of remodelling the distributing system—as a general rule. For the higher the efficiency of the lamp, the greater necessity for very close regulation of pressure applied. In order to obtain this very close regulation, the entire secondary wiring, including the house work, must be planned with very small allowance for drop, and transformers used of a low "drop" percentage. Whether, under the existing conditions of investment, etc., it is really worth the while of any particular plant to rearrange its distributing system to suit the requirements of more economical lamps, in order to enlarge its income, is a matter for careful consideration. The factors entering into the discussion are: A double benefit results from the use of higher efficiency lamps, first, the reduction of the power required per lamp, and, next, the increased number of lamps that can be supplied by the same power. In a 1,000 light plant the coal saving would probably amount in the course of 12 months to $30 by using 3 watt and 3½ watt lamps. This $30 saving would pay 6% on $500, which would go a long way towards rendering the distributing system fit for such high efficiency lamps. Or if the lines were not remodelled, then the $30 could be devoted to the replacing of such lamps as suffered by the variations in pressure. But the main advantage would be in the fact that more lamps could be supplied by the same machinery. In this sized plants the rental might be increased by at least $50, which would pay a month's wages to the engineer. It is very cheap to sneer at such small savings, but nowadays, with competition from gas and acetylene, and rates being forced down by town councils, dividends must be looked for much more closely and carefully than formerly, and the engineer who does not care to save $50 deserves to lose his place. An engineer who is not above saving $50 in one direction, is very likely to have his wits so sharpened, that he will see another $50 somewhere else.

A thoughtful consideration of the rate schedules of many medium sized plants will reveal many anomalies, and if done in a systematized way by a considerable proportion of the more progressive managers, will probably prepare the way for a more scientific and equitable method, which, after the usual grumbling attending all changes, will give more general satisfaction to both consumers and producers. It is usual to give the same meter rate to all consumers, no matter how large or small their requirements, or what the class of business, whether residential or commercial. Here is an actual case: A prominent politician in a certain town took forty 16 c.p. lamps, in billiard room, large drawing room and other public rooms seldom used, and elsewhere where their use was continuous. His family being small, he really occupied only part of the house, and the whole family always spent about half the year away from home. Paying by meter, of course there was no income from this installation half the year, when the house was shut up. During the other six months the occasions when the house was fully lighted were, as can be expected, few, and the actual consumption of energy was for at least five days a week about what an average 10-light installation should reasonably expect to pay for. This means that the consumer required four per cent. of the total capacity of the plant to be held at his disposal during the entire twelve months, while he paid for the privilege just half as much as another consumer who required only one per cent. of the total capacity. In other words, this extraordinary condition existed that the latter consumer's rate for current was eight times as much as the former's. There are many plants where all wiring is done by the company without charge to the consumer. In such a case, it will be evident that a consumer whose maximum demand bears a large ratio to his average may actually be a source of loss to the power house.

In the above instance, the power house was entitled to expect an amount of business sufficient to pay four per cent. of the entire fixed expenses of the plant, for interest, depreciation, wages, maintenance, insurance, taxes, and also the cost of the coal and water consumed in supplying the amount of energy actually used. The actual payment was, over and above the cost of coal and water consumed, just one-half of one per cent. of all the fixed expenses. The total annual fixed expenses of such a plant that could be fairly charged against the incandescent business amounted to about $2,000. The above installation should have paid four per cent., or $80; it really paid $10. In a limited sized plant, where the demand for light—or the possible demand—is a little beyond the capacity, such an installation is relatively an actual loss. It is an exaggerated case, although an actual one, but every plant that sells by meter will have some similar experience. Many a house is wired for fifteen lights, while the average consumption is reasonable for four. The maximum number burning at any time will be possibly eight or nine. Here, while the consumer should (on the above basis) pay one-eighth of the fixed expenses, he actually pays only one-sixteenth, or half as much as he should. It is true that the difference amounts only to $4, but he is paying the power house for energy $4 less than it costs to produce that energy. This is one good way to avoid being troubled with having dividends. The remedy is simple, and suggests itself at once. A minimum charge should be made to a consumer, proportionate to the size of his installation to cover his proportion of all the fixed expenses of the plant, and then the energy consumed as registered by the meter should be charged in addition. In this way only will each and every consumer pay a fair proportion of the expenses. The way of determining this minimum charge is to establish what are the fixed expenses of the plant, taking into consideration always interest on first cost, depreciation at a percentage, insurance, taxes, and dividing the total by the number of lamps which can be expected. Then each lamp must return at least this calculated minimum, in order that it may pay its way. If it does not, then it simply represents bad business.

It may be objected that to charge this minimum will cause the loss of many customers, and that such method is unnecessary because the results of the whole year's operation are a dividend; that the good and the bad must be taken together; and the policy of management must be judged in the bulk, and not piecemeal. This point is well taken where the business is not sufficient to fill the power-house up to its full capacity: but in many plants it is beyond the present capacity, but hardly enough to justify a considerable increase. In such a case the substitution of a consumer whose average consumption is nearer to his maximum for one whose installation is largely in excess of his usual requirements, is evidently a clear gain to the plant. If instead of the one 60 light customer with his six months' absence and average of 10 lights, five customers could be obtained for eight lights each with an average requirement of four all the year, the result to the plant would be twenty paying lights for twelve months, instead of only ten paying lights for six months. It is very probable that, if a minimum rate be charged for water supply, the business of some consumers would drop off altogether, because it would take some time for people to understand that if they require a certain proportion of the power house to be reserved for their use (and thus render it unavailable for other business) they should pay for the privilege whether they use it or not.

Still, it is plain that a thoroughly successful business cannot be built up on erroneous principles, and it does not seem equitable that the small consumers—who really are the best paying ones—should be discriminated against so very heavily as in the above example.

The imposition of a minimum yearly or monthly sum in proportion to the number of lights installed to cover all the fixed expenses of the power house, should be offset by taking out that factor in calculating the cost per kilowatt hour. The resultant meter charge per k.w. hr. would be found to be so greatly reduced as to attract many new consumers, to the great advantage of the business.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 6th of each month.

THE STEAM BOILER AND ITS SAFETY.*

By F. G. MITCHELL, M.E., London.

THE modern demand for high pressure engines is fostering sectional and water-tube boilers. The more rapid adoption of such boilers is retarded on account of so many of their parts being made of cast iron, together with so many joints and connections. These are objected to by the old type manufacturers and those unwilling to accept something new. Nevertheless, the external, horizontal, tubular boiler will soon be out of the modern class as a steam generator. It is limited in the thickness of sheet, and therefore in its diameter. Consequently, on account of its being externally fired, its pressure and power is limited. This alone has turned the attention of boiler manufacturers to a more perfect arrangement for stationary as well as marine purposes.

At the present day the demand is for high pressure in stationary boilers, embracing several designs of water tube and internally fixed boilers of different type. From an economical standpoint there is little difference, notwithstanding the claims and reports of efficient tests advanced by the makers of the different designs. On the other hand, as to the safe working pressure of the boiler, we are compelled to take the maker's figures, as there is no law in this province formulating the proper rules founded on mechanical principles to determine the safe working pressure of the steam boiler.

An instance of the above occurred to me quite recently when called upon to inspect a horizontal, tubular, externally fired boiler. The dimensions of the boiler were 72″ diameter and 16′ long. The plates were of steel $\frac{3}{8}''$ thick, with a tensile strength of 60,000 lbs. per sq. inch. There were 114 – 3″ tubes and the heads were of flange steel $\frac{1}{2}''$ thick. The longitudinal joints were double riveted, the rivets being $\frac{3}{4}''$ in diameter, and the pitch 3″, and it is fair to suppose the holes at $\frac{13}{16}''$. The efficiency of the joint so far as net sections of plate are concerned is $3'' - 8125 \div 3'' = 72.9\%$. The area of a $\frac{13}{16}''$ hole being 0.5185 sq. in., the single shearing strength of one rivet is $.5185 \times 38{,}000 = 19{,}700$ lbs. As there are two rivets in a unit section of the joint (the joint being double riveted), the total shearing strength of the rivets in a unit section is 39,400 lbs. The strength of a strip of the solid plate 3″ wide being $3 \times \frac{3}{8} \times 60{,}000$ lbs, is equal to 67,500 lbs. Then, for the efficiency of the joint, so far as the rivet area is concerned, is 39,400 divided by $67.500 = 58.4\%$. This is much less than the efficiency of the net section, therefore it follows that the joint is badly proportioned. The rivet area is too small; notwithstanding this, the builders had no hesitation in recommending this boiler for a safe working pressure of 100 lbs. per sq. inch, whereas with a factor of safety of 5, the safe working pressure on it is 73 lbs. per sq. inch. The safety valve was set at 100 lbs. per sq. inch, and the owners of this boiler congratulated themselves on their new steel boiler. Really, the boiler was no stronger with the 60,000 lbs. steel than it would have been with 50,000 lbs. iron. Now, a proper double-riveted lap joint for this boiler would be, diameter of rivet $\frac{7}{8}''$, pitch $3 - \frac{7}{16}''$; efficiency of joint 69.4%. This would give a safe working pressure (with a factor of 5) of 87 lbs. per sq. inch.

Many years ago Sir William Fairbairn stated the efficiency of a single riveted joint to be 56%, and that of a double riveted joint to be 70%. No doubt he meant it to be understood that this was the limit practically obtainable with careful design and construction, and I am sorry to say that it is a common practice among engineers who should know better, to allow 56 and 70 per cent. for single and double riveted joints respectively, without the least regard to the actual proportions of the joint.

Another case which came under my observation not long ago was a horizontal, tubular boiler, externally fired, 48″ diam. and 12′ long. The plates were of steel, 60,000 lbs. tensile strength, $\frac{5}{16}''$ thick and single riveted. The diameter of the rivets was $\frac{5}{8}$, and the pitch $1 - \frac{3}{4}''$, and the heads $\frac{3}{8}''$ thick. The workmanship of this boiler was excellent in every respect, and I believe the material was also. The only objectionable point about the boiler was the riveted joint. The diameter of the rivets being $\frac{5}{8}''$, we will suppose the holes to be $\frac{11}{16}''$, or 0.6875. The pitch being 1.75, the efficiency of the joint so far as the net section of the plate is concerned is $\frac{1.75'' - 0.6875}{1.75} - 60.7\%$. The area of a $\frac{11}{16}$ hole being 0.3712 sq. in., the strength of one rivet (assuming the shearing strength of rivet iron were to be 38,000 lbs. per sq. inch) is $3712 \times 38{,}000 = 14{,}100$ lbs., and the strength of a strip of the solid plate 1.75″ wide being $1.75 \times \frac{5}{16}'' \times 60{,}000 = 32{,}800$ lbs. We find that the efficiency of the joint so far as the rivet section is concerned is 14,000 divided by $32{,}800 = 43\%$, whereas if properly designed it should be 56%. Now, why is it that an otherwise good boiler manufacturer will allow construction such as this? He might as easily, and without any more expense, have turned out a very much better and safer boiler. It may be possible that the templets used had been arranged for 40,000 or 45,000 lbs. per sq. inch iron. But this does not explain the whole thing, for nowadays the manufacturer will go even a step closer by using only a factor of 4 with practically the same externally fired boiler.

There are many defects that are likely to be found about a steam boiler, and the ones most common are corrosion and grooving along the girth seams, generally on the bottom sheets, and cracks extending from the edge of the sheet to the rivet holes. On the outside landing, this is more often found where heavy plates are used. The most serious form of corrosion is that which attacks the plates along the water level, forming a continuous line of weakness. This is, of course, due to the acids in the feed water, and can only be remedied by improving the supply. External grooving is often due to leaky calking, and is very often caused by the use of what is known as a split calking tool having broken the skin of the metal. Buckled or boged sheets usually result from neglect in keeping the boiler clean. Soft deposits are permitted to accumulate over the fire and become hard, allowing the plates to become overheated and to be pushed down with the pressure. In iron boilers this has been attended by ruptures, while in steel boilers the buckled part grooves thinner at its lowest point until a small hole causes a leak.

I wish to mention, before closing, a very important consideration about the steam boiler, and that is, the so-called mountings. How many boilers do we meet with that have a perfect working safety valve, one that will permit the escape of steam as fast as the boiler will generate it, and not allow the pressure to exceed at most 10 lbs. above what it was set for? Anything else is only an excuse for a safety valve. It is also a common thing to see water columns connected to the boiler with ½ and ¾ pipe and with 3 and 4 bends in it, and a small pet-cock at the bottom to blow it out? This is another excuse. Also, how often do we see a common plug-cock put on for a bottom blow-off? There are no mountings or fittings too good for a boiler, and none other should be used or allowed to be used.

* Paper read before the Hamilton Association, C.A.S.E., at December meeting.

WATER POWER ARBITRATION.

IN regard to an item in our last issue in reference to an arbitration between the Laurentide Pulp Co. at Grande Mere, on the St. Maurice river, and the province of Quebec, as to the purchase of some six islands in the river at that point, we desire to state that the great water power at Shawenegan Falls was not in any way connected with the matter in question. That part of the property at this point upon which any considerable water power development must be made is owned by Mr. John Forman, of Montreal, and he expects to be able to utilize it in the near future. Its importance may be surmised from the information given us that it is possible upon this property to create a development of 200,000 to 250,000 horse power, at a cost per horse power not approachable by any water power, so far as is known, upon this continent. For electrical developments, particularly, this property offers the most extraordinary advantages, and the recent completion and operation of the Great Northern Railway to within a mile and a quarter of the property brings these advantages within commercial reach.

As to the arbitration between the Laurentide Pulp Company and the province of Quebec, we learn that some of the islands were in the water fall of Chute de la Grande Mere, and the others in the river close by, and that the right was asked to partially fill up the bay below the falls, and so create a so-called beach lot. The arbitrators absolutely refused to commit themselves, and inasmuch as the Laurentide Co. now own the whole of the land on each side of the river, as well as all the islands in the river at that point, they can use the whole of the water in the river at that point, if this were possible, without the slightest interference from anyone, so long as they leave water enough in the channel to drive the logs of the lumbermen.

The horizontally set Crocker turbine for the electric light plant at Weedon, Que., has arrived from Sherbrooke, and is being connected to generators.

THE LONDON SPECIFICATIONS.

TORONTO, ONT., Dec. 17th, 1898.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—Replying to yours of 29th August, I have been out of Toronto since then, but if of any interest at this late date, would comment on the London specifications as follows:

I don't think it right to call for tenders on work that has not been previously sanctioned by the ratepayers; it is simply intended as a menace to the existing company, and is not a proceeding creditable to the London corporation.

The specifications do not interest Canadian manufacturers, as they distinctly call for a Brush machine and an Adams-Bagnall lamp. To specify a particular efficiency is beyond the scope of an engineer's duty. Efficiency is of value merely in relation to price. A high efficiency machine may be held at so high a figure that one of lower actual efficiency and less cost may be the better investment. There is many a good machine made that will not reach 86%; these are all excluded. The amount of belting required is not mentioned, although a detail so important might be expected in a specification that considers it necessary to specify that "armatures shall be electrically and mechanically balanced." I do not believe in any such fancy tests as short-circuiting a machine for five minutes. Its imposition shows that the engineer does not understand the operation of an automatic current regulator.

As to lamps, no engineer has a right to specify any particular apparatus, more especially when, as is abundantly evident in this case, he knows nothing about it. The Adams-Bagnall lamp contains certain patented features, which the London engineer, probably after "expert" investigation, decided would render it superior to any other. And yet his investigation, while convincing him of its superiority, leaves him in the dark as to whether it contains complicated clockwork mechanism or even the usual cut-out device! This is evident, for he states it must not have the one and must have the other. The London engineer's opinion on such a point is evidently of value. Having demanded a particular lamp, can he justly hold a contractor responsible for its "flaming or hissing"?

The rest of the specifications illustrate the general principle that when amateurs go into details they are sure to leave out as much as they put in, and to leave loop-holes everywhere. It is a pure waste of time to specify the dimensions of cross-arms. I should say that the clauses covering everything but machines and lamps represent the result of a careful study on the part of the engineer of the outside work of the London Electric Co. On the whole, the specification appears to be largely composed of sentences copied out of manufacturers' catalogues descriptive of their apparatus, held together by words and conditions representing the knowledge of one who had to measure a cross-arm. It is about the most hare-faced confession of ignorance and partiality that could be decently made, and I do not for one moment believe that it is the work of the London city engineer. It is the result of collaboration between the agents of a manufacturing company and some pushing lineman.

Yours truly,
GEORGE WHITE-FRASER.

LARGE SALE OF RAILWAY APPARATUS.

MR. W. A. Johnson, of the W. A. Johnson Electric Company, reports the recent sale of Westinghouse apparatus to the Metropolitan Railway Company of Toronto, to be used in connection with the extension of the present railway to Lake Simcoe. In the power house at Bond Lake will be installed two 60-cycle, three-phase A.C. D.C. generators, each of about 400 h.p.; and a full complement of switchboard apparatus, step-up transformers, lightning protection, etc., will be provided. The transmission voltage will be 16,500. There will be two rotary transformers, 60 cycles, three-phase, giving 570 volts on direct current side. These will be located at sub-stations about 14 miles from the generating station, step-down static transformers being provided to reduce the voltage to that suitable for the rotaries. The generator switchboard will consist of eight marble panels, the sub-station switchboards of five marble panels, with non-arcing and tank lightning arresters. In addition to the above, there will be passenger and freight car equipments, including one quadruple equipment for heavy freight car and double equipments for two-light freight cars, two double equipments for ordinary passenger cars, and two quadruple equipments for heavy passenger coaches; the motors being used in these will be 38 B. 50 h.p. each. We believe this is the first installation in Canada to use a generator delivering both direct and alternating current from the same machine, as well as the first application of rotary transformers. The sale includes one 45-ton Baldwin-Westinghouse electric locomotive.

AN INCORRECT ADDRESS.

A MISLEADING error occurred in the reference to the new quarters of Messrs. Ness, McLaren & Bate, Montreal, which appeared in our last issue. Their factory, office and show-rooms are located at 419 St. James street, corner of Craig, instead of at the corner of Seigneurs and Craig streets, as given. Persons desirous of purchasing telephones, telegraph instruments, annunciators, switch-boards, fire alarm apparatus and other electrical supplies are requested to note this correction.

WARNING AGAINST ACETYLENE.

THE Rat Portage Miner & Rainy Lake Journal quotes as follows from the Boston Herald: Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Company, in view of recent renewed efforts to introduce calcium carbide and acetylene gas into commercial and manufacturing establishments, has published a cautionary circular in which he says:

"The purpose of this caution is to call upon each and all of our members not to make use either of calcium or acetylene gas without full advisement and consultation at the time the proposed application is to be made. It may happen that the use of these materials may be made safe. At present they are not deemed so. Therefore the introduction of either, without the consent of the underwriters, would make an alteration in the condition of the risk not contemplated in the original contract. It is therefore suggested that no new method of lighting shall be permitted, even for experiment, without consultation."

ENGINEERING NOTES.

A rule by which to estimate the power of a double belt is given as follows: Divide the number of square feet that passes over one of the pulleys in a minute by 40. The result will be the power that it can develop. The authority which gives it says that it does not contain many fine points, but the results are just as reliable as those obtained by more complicated methods. Probably this is true.

OIL FOR BOILER SCALE.—The use of oil as a scale remover in steam boilers is treated in an article in a recent issue of The Locomotive, the conclusions of which are summed up as follows: Mineral oil is often useful for the prevention or removal of scale, when it is properly applied; in the prevailing method of introduction, it gives good results in many cases; but when it has not proved as effective as desired, we recommend that the boiler be dried out and that the kerosene be sprayed upon the plates and tubes. It is important to avoid the use of open lights in or about a boiler that is being so treated; incandescent electric lights are the safest to use. Finally, kerosene is very serviceable for removing lubricating oils from plates and tubes.

ROPE TRANSMISSION.—In a paper on power transmission by ropes and belts, read before the French Society of Civil Engineers, V. Dubreuil states that one great advantage possessed by ropes is that cyclical variations in the speed of the driving pulley are "damped" by the ropes, so that the speed of the driving pulley is much more uniform than that of the driver. Ropes are also useful when the two lines of shafting are not perfectly parallel. The velocity of the rope should not be less than about 4,500 feet per minute, nor more than 5,000 feet, while with belts a velocity of as little as 600 feet per minute may be used, but the maximum should not exceed 4,000 feet per minute, above which the centrifugal force prevents the proper adhesion of the belt to the pulley. For great distances between the lines of shafting ropes should be used; though in exceptional cases they may be employed with as little as 12 feet between shaft centres, in general the distance should not be less than 20 feet. Spans of as much as 328 feet have been worked by ropes with only intermediate support. Under no circumstances should the diameter of the smallest pulley be less than 30 times the diameter of the rope, and in general the pulley ratio should not be greater than four to one. Three standard ropes of manila, hemp or cotton may be used. Hemp is much cheaper than cotton, and usually wears longer, but is less pliable. To facilitate estimates, the approximate weight of a rope pulley may be taken as 5½ pounds per groove for each inch of diameter, though single groove pulleys will weigh double this amount.

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The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. The paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

Subscribers may have the mailing address changed as often as desired. When ordering change, always give the old as well as the new address.

The Publishers should be notified of the failure of subscribers to receive their paper promptly and regularly.

EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Electrical Students' Competition. IN the announcement which appeared in last issue headed "Canadian Electrical Students' Competition," a typographical error was made. In the subjects of theses, No. 5 should have read, "A Concise Description of a Method of Testing Transformers for Efficiency at Various Loads, both as regards Regulation and Core Loss." Students of electricity who may not have learned of the competition mentioned are referred to our December issue for particulars, and are urged to enter the list of competitors for the prizes offered.

Settlement by Arbitration. THE arbitrators named to adjust the difficulties between the Grand Trunk Railway Company and the telegraph operators employed on the road assumed their duties in Toronto on January 7th. The company is represented by Mr. B. B. Osler, Q. C., the telegraphers by Grand Master Sergeant, while Chief Justice Meredith is acting as the third arbitrator. The two subjects to be adjusted are a minimum rate of wages and the hours of labor, and those interested believe that an early settlement will be arrived at. That this method of reaching an understanding between the representatives of capital and labor has been decided upon, is a tribute to the greater enlightenment of the people in the closing years of the nineteenth century. The day seems near at hand when labor strikes will become relics of the past.

Long Distance Transmission of Power. AN interesting paper on this subject was recently presented before the Society of Arts, London, by Prof. George Forbes, under whose direction the huge enterprise of the Cataract Power Co. at Niagara Falls was planned and put in operation. Prof. Forbes gives it as his opinion that electric power can be transmitted to a

distance of 500 miles, using a pressure of 20,000 to 30,000 volts, and that under certain circumstances electric power could be thus transmitted at a profit. He claims that the power of the Victoria Falls on the Zambesi river might in this manner be economically employed in the mines of Rhodesia, and that the city of Cairo could be lighted more cheaply by means of current generated at and transmitted from the First Cataract, 400 miles distant, than by steam engines on the ground.

Street Railway Organization.

OUR attention has recently been called to the necessity of an organization representing the street railway interests of Canada, and we are pleased to learn that in some quarters there is a strong feeling in favor of such a movement It seems that the smaller roads are the most anxious that the formation of an association should be effected. It is pointed out that there are many questions in common affecting the operation of street railways which might with great advantage be dealt with by an association. If taken up independently, the expense and trouble of adjustment is certain to be much greater and the results less satisfactory. The difficulty, in this country, of working successfully an association composed of street railway officials is quite apparent. The limited number of railways necessarily prohibits a large membership, while the great distance from the east to west of the Dominion makes it extremely doubtful that members could be secured in British Columbia, New Brunswick and Nova Scotia. This would confine the membership, in reality, to Ontario and Quebec. The suggestion has been made that there be formed a street railway section of the Canadian Electrical Association. This would be, perhaps, the wiser course to pursue. In the past, we fear the association named has been regarded as non-representative of the street railway branch of the electrical industry, but this has been due to the fact that it received its chief support from the electric lighting, telephone and telegraph interests. Just how to effect an organization that will best serve the interests of the street railway companies cannot be easily defined, but we have referred to the matter in the hope that a discussion may be provoked, and some course of action outlined by those interested.

The Niagara Falls Power Franchise.

THE time granted by the Ontario government to the Canadian Niagara Power Company for the development of a fixed quantity of power on the Canadian side of Niagara Falls expired on November 1st, 1898. The company not having fulfilled its agreement in this respect, the question was submitted to the courts to decide whether or not the franchise should be declared void. The questions which the High Court of Justice was asked to decide were as follows: 1st. Is the agreement void by reason of the failure of the Canadian Niagara Power Company to have 10,000 horse power developed and ready for use by November 1st last? 2nd. May the government declare the agreement forfeited? 3rd. If the agreement cannot be declared wholly at an end, is the government relieved from the agreement not to grant to any other person the right to use the waters of the Niagara river? To each of these questions a negative decision was given, thus permitting the Canadian Niagara Power Company to continue to hold its franchise. That all our readers may understand the situation, we will review, briefly, the circumstances of the case. In April, 1892, the Canadian Niagara Power Company entered into an agreement with the commissioners of Queen Victoria Niagara Falls Park, which agreement was ratified by the Ontario government, whereby the company secured exclusive control of the right to develop power on the Canadian side of the Niagara river, in return for an annual payment of $25,000 for the first ten years, the amount to be increased $1,000 for each year of the second decade until the annual rental shall have reached $35,000, at which figure it might be continued for 80 years. A provision of the agreement was that by November 1st, 1898, the company should have completed water connections for the development of 25,000 horse power, and have actually ready for use and transmission 10,000 horse power. Some time previous to November 1st, the company applied to the park commissioners for an extension of time, but the Ontario government, although hesitatingly, refused to grant the request. Recourse was then taken to the courts to ascertain if the Niagara Power Company still had any legal right to the franchise, with the result given above. The ruling of the court certainly seems ambiguous, inasmuch as it places the owners of the franchise in an almost helpless position. If a violation of the terms of the agreement is not sufficient to annul the contract, the entire agreement is of little value. There are some peculiar features of the case. The company contend that they have supplied the local demand, and that up to the present the problem of long distance transmission has not been satisfactorily solved. Their method of supplying the local demand was by placing two 500 horse power generators in the power house of the Niagara Falls Park and River Railway, situated within the park limits. These are belt driven by the two turbines of the railway company. This 1,000 horse power is almost entirely consumed by the Carborundum Company, the Niagara Falls Electric Light Company, and the Carmelite Monastery. It might be asked what the intention of the government was in granting to a syndicate the right to utilize the Niagara power. Was it not that the development of the power would create a growth of industrial establishments in the vicinity, the supplying of the then existing demand being of minor importance? It is noteworthy that while practically nothing has been done towards utilizing the immense water power of Niagara Falls, the owners of the franchise have permitted the Cataract Power Company of Hamilton to cut off one of their most promising fields for exploitation, namely, the city of Hamilton, while we would not be surprised if, in the near future, the same company would be supplying current to the city of Toronto. This fact, and the apparent indifference and inactivity of the Niagara Company, gives color to the suspicion expressed in some quarters that in securing control of the franchise the Canadian Niagara Power Company had some other motive than that of developing the power. What course will now be taken is a matter of interest. Should the courts not be asked to decide what time shall be given the company for the execution of the work agreed upon?

The National Carbon Company, of Cleveland, Ohio, have sent us a neat calendar, on which is shown a view of their extensive works. It also includes the moonlight schedule for the current year.

The 60 k.w. S.K.C. generator of the Dundas Electric Co. has been placed in position. They expect to have their water-power in operation in a few days, and will begin the lighting of the city by the 15th of January.

TELEGRAPH and TELEPHONE

THE TELEPHONE IN MONTREAL.

THE Montreal Telegraph Company, which had control of the Edison patents, and the Dominion Telegraph Company, which originally exploited the Bell telephone patent, both commenced operating telephone exchanges in Montreal in 1878. In 1880 the Bell Telephone Company was organized, and immediately combined these two exchanges into one, at the same time consolidating the whole telephone business of the Dominion under one head. Starting with a capital of $500,000, the progress of the corporation was extremely rapid, until now its capitalization is represented by millions. During its history the company has occupied three different buildings for its main exchange in Montreal. From 1880 to 1885 it tenanted the upper flat of the City and District Savings Bank; the upper flat of the British Empire building was occupied from 1885 to 1897, and in Jubilee year the company moved into its new headquarters on the corner of St. John and Notre Dame streets.

The new building is in every respect a credit to the city. The dimensions are 108 feet on St. John street, 35 feet on Notre Dame street, and 98 feet on Hospital street, six stories in height. On the ground floor are located the local offices of the company, the long distance telephone rooms and waiting rooms. The first and second floors, and a part of the third, are rented as offices, etc. On the third floor is situated the battery room, chief operator's room, offices, etc. On the fourth floor is the company's work-room. The Bell Telephone Company has four other exchanges in Montreal, one at the corner of St. Catherine and St. Andre streets, one at the corner of Mountain and St. Catharine streets, one at 2452 Notre Dame street, and one at Westmount. The switchboards in these exchanges were put in at an aggregate cost of $220,000, that at the main exchange alone costing $120,000.

MR. C. F. SISE,
President Bell Telephone Company.

The business of the company is growing rapidly. Instead of receiving about 200 calls a day, as in 1880, when the exchange was opened, the average number of calls daily in Montreal is now about 117,000, and 171 young ladies are employed to answer the calls.

Previous to 1892 the Bell Telephone Company manufactured their own appliances and instruments. In that year they were succeeded by the Northern Electric Company, who have a large factory on Aqueduct street. The factory commenced operations with three men, but now employs 250. The building covers a floor area of about 30,500 square feet, and contains under one roof a mechanical department, finishing room, brass foundry, nickel-plating room, buffing room, blacksmith shop, polishing room, wire insulation department, battery department, engine room and carpenter's shop. There are upwards of 250 different machines used in the processes of manufacture.

MR. C. W. BROWN,
Superintendent Northern Electric Company.

Presented herewith are portraits of Mr. C. F. Sise, the organizer and president of the Bell Telephone Company, and Mr. C. W. Brown, superintendent of the Northern Electric Company.

VALUE OF TELEPHONE PLANT.

THE appeal of the Bell Telephone Company against an assessment of $638,649 on their plant in Toronto, was argued before Judges McDougall, Dartnell and McGibbon last month. Previously the plant had been assessed at $100,000. This year the assessment was proportioned as follows: Land, $8,750; buildings, $24,000; poles, wires, conduits, etc., $377,992; Temperance street switchboard, $177,174; Yorkville and Parkdale switchboards, $50,773. The decision of the Court of Appeal in the case of the assessment of the Bell Company's plant at Hamilton stood as a precedent. This decision held that the poles, wires, etc., could not be assessed for their value as a part of a growing concern, but only on their value when detached, or as scrap iron.

Mr. Albert L. Salt, assistant manager of the Western Electric Company, New York, was the first witness. He gave his estimate of the value of the switchboards as follows: Temperance street $10,000; Yorkville avenue, $1,900; Parkdale, $565.50.

Mr. Wm. C. Marshall, inspector for the C. P. R. Telegraph Company, said that the wires, poles, etc., of the company were of no value when detached. They would not realize, on sale, the cost of taking them down. The only articles which were of any value were the braces, which, when taken down, would realize about five cents each, half of their original cost. The wire would cost about four dollars a mile to take down, which was more than they would sell for as scrap. Mr. J. J. Wright, manager of the Toronto Electric Light Company, gave similar testimony.

Mr. Edward F. Peck, electric light superintendent at Brooklyn, N.Y., said that, as an outgrowth of his eighteen years' experience, he considered that the Bell poles could be removed, as they stood, for from 25 cents each to $2.50. It was worth $2 to erect a 25-foot pole. There was no market for taken-down galvanized iron wire. The aerial wire, he said, was valuable only as scrap iron.

Mr. Hugh C. Baker, manager of the Bell Telephone Company in Ontario, stated that the company had invested in the Dominion, in realty, $4,171,432.91. This included everything except switchboard instruments and indoor plant. He believed the average life of poles in Toronto to be about six years; they had now lived half their life; the cables, underground, had been used about four years. Cables were worth from five cents to

eleven cents per foot ; some had been sold at $35 per ton. Wire was worth nine or ten cents a pound when taken down. Poles taken down found little market, and would be worth from 25 cents to $2, according to size.

Expert evidence was also submitted by Messrs. W. Bamfield, of Pittsburg, formerly manager of the Pennsylvania Telephone Company, Jno. C. Reilly, general superintendent of the New York and New Jersey Telephone Company, and others, the case occupying several days. The decision of the court was in favor of the Bell Telephone Company, the assessment being reduced to $102,550, made up as follows : Poles, wires and conduits, $53,900; Temperance street switchboard, $12,000 ; Yorkville avenue and Parkdale switchboards, $3,900 ; land and buildings, $32,750.

The court found as follows : "The wooden poles are valued at 25 cents each ; the rails and iron poles, considered as "scrap," what the market allows, including cost of removal, etc., are put at $3.50 per ton net ; the wire is rated as second-hand and is worth nine cents a pound, while the attachments are valued at seven cents a pound—all considered as scrap."

MR. FREDERIC A. HAMILTON.

FEW persons in Canada have had a more extensive experience in sub-marine telegraphy and general cable work than the subject of this sketch, Mr. Frederic A. Hamilton, M.I.E.E., M. Can. Soc. C.E. A brief resume of his services in this connection will no doubt interest many of our readers. He was born at Dover, England, in the year 1843, and after leaving school engaged in the mercantile marine, sailing to India, Australia, New Zealand and the Mediterraneum. He served as a volunteer in the war for Italian Unity under General Garibaldi.

Mr. Hamilton first entered the telegraph field about 1868, studying as a probationer with the Sub-Marine Telegraph Company,

MR. FREDERIC A. HAMILTON.

one of the oldest companies working between Great Britain and the continent of Europe, until a vacancy offered in the service of the Anglo-Mediterraneum Telegraph Company. He was employed on their Susa-Modica line, at the stations at Naples and Messina, and was appointed manager at Florence, but being desirous of gaining experience in sub-marine telegraphy, resigned and returned to England, and received an appointment in the Telegraph Construction and Maintenance Company as assistant electrician. Whilst in this company's service he was employed in the factories at Greenwich during the manufacture of the Falmouth, Gibraltar and Malta cables, and on the expeditions engaged in laying the Mid-Channel cable, Lisbon-Falmouth, Batavia-Singapore, Singapore-Penang, Penang-Madras, Singapore-Hong-Kong, and Batavia-Singapore sections, both on shore and ship. He was also engaged in removing faults from subterraneum cables.

Mr. Hamilton was also identified with the manufacture and laying of the Ireland-Newfoundland cable and the Newfoundland-Cape Breton cables, being on board the ship laying the Sydney-St. Pierre section, and on shore at St. Pierre during the submersion of the St. Pierre-Placenbia section, as well as executing other responsible commissions. He was on board the "Great Eastern" in expedition for repair of the 1865 Atlantic cable in Mid-Atlantic, and was chief electrician on the Cuba cable repairs and in laying shore-end of Brazilian cable at Pernambuco.

In the year 1875 Mr. Hamilton was employed in the traffic manager's department of the Direct United States Cable Company, and in the following year was appointed electrician-in-chief to the Anglo-American Telegraph Company, being sixteen years in this company's service. During the above period he was engaged in numerous undertakings in cable laying and repairing, and in other operations at sea and on shore, in connection with the telegraph system of the North Atlantic. This experience afforded a wide range of knowledge with regard to the various methods of working sub-marine cables, both long and short by Simplex and by Duplex, and especially embracing the important considerations involved in the question of the selection of tracks, a feature closely connected with the study of the principal causes of rupture and injury to sub-marine cables. His services in this capacity were greatly appreciated, and upon several occasions the late Sir John Pender and Mr. Henry Weaver, late managing director of the Anglo-American Telegraph Company, took occasion to commend him upon the ability displayed. Since resigning from the above company in 1892, Mr. Hamilton has been practising as an electrical engineer in Halifax, N.S. He has had considerable experience in the installation of electric light plants both afloat and on shore, and in his private practice has introduced the same degree of thoroughness which was one of the chief factors of his success in telegraph work.

Mr. Hamilton was elected an associate of the Institution of Electrical Engineers in 1873, and was advanced to member in 1886. He is also a member of the Canadian Society of Civil Engineers and the Maritime Electrical Association. It will be remembered that at the convention of the latter society in September last, he presented an interesting paper on "Electric Gong Buoys– Audible vs. Visual Signals." He has also contributed to the Journal of the Institution of Electrical Engineers papers on "Submarine Cables," "Shipping Buoys from Cable Ships," and "Repairs to Submarine Cables," and to the Canadian Magazine an article on "Laying a Sub-Marine Cable."

SHORT-CIRCUITS.

Mr. Fred. Cleveland, formerly of the Great Northwestern Telegraph Company, Montreal, spent a few days in that city at Christmas, visiting his friends.

The Victoria Telephone Company held its annual meeting at Beaverton, Ont., last month, at which it was decided to extend the system to Pefferlaw, Beaverton and Bolsover.

The Department of Public Works at Ottawa has invited tenders for the construction of a telegraph line from Alberni to Cape Veale, in British Columbia, a distance of 38 miles.

Mr. R. B. McMicking, manager of the Victoria and Esquimault Telephone Company, Victoria, B.C., was recently presented by his employees with a pretty cane, ornamented with silver bands and tips, and suitably engraved.

Mr. William H. Hayes, assistant manager of the Bell Telephone Company at London, Ont., has been transferred to Windsor, where he will assume the position of local manager. Mr. Hayes is to be congratulated upon his promotion.

It is said that four Ottawa barristers will seek incorporation at the next session of the Dominion parliament as the Royal Telegraph Company, with a capital of $1,000,000. It is proposed to construct and operate telegraph and telephone lines throughout the Dominion.

The Merchants' Telephone Company, of Montreal, was organized in 1893 by Messrs. A. S. Moisan and J. M. Marcotte, now president and secretary respectfully of the company. The exchange was opened on January 1st, 1895, with 472 subscribers. Since that time the number has increased to 1,800, twenty-two operators being employed.

Mr. Charles R. Hosmer, manager of the C. P. R. Telegraph Company, returned to Montreal a fortnight ago after a six weeks, visit to London and Paris. Shortly after his arrival home he received a cablegram announcing the dangerous illness of his daughter, whom he had left in Paris to complete her education, and was compelled to return again to Paris.

While repairing the wires of the Great Northwestern Telegraph Company, in Montreal, after the recent sleet storm, Pierre Brouillet, who had ascended a pole on Craig street, in company with two other linemen, came in contact with a live wire. The Montreal Gazette states that, although he received a shock of upwards of 2,500 volts, the only visible signs are two slight black lines on each hand.

REPORT AS TO ELECTRIC LIGHTING IN PEMBROKE.

BELOW will be found a copy of the advisory report of Mr. Roderick J. Parke, E.E., submitted to the municipal council of Pembroke, Ont., regarding electric lighting. Mr. Parke was retained by the Council to assist them in overcoming a difficulty with the Pembroke Electric Light Company, and in that connection to furnish estimates of the cost of a municipal plant. The report is a particularly interesting one, and although taking a neutral standpoint, is none the less valuable :

In formulating this report, advising you as herein, I assume a strictly neutral standpoint between the two principals concerned, namely, the citizens or corporation of Pembroke, represented by your honorable body, and the Pembroke Electric Light Company, controlling the supply of electrical illumination in Pembroke. This position I take upon my own responsibility, as in taking it I can the better assist and advise you toward the attainment of the most desirable results in dealing with the company, while at the same time respecting its lawful rights, as you desire to do. It is not my intention to interfere with the rights or operations of the company, beyond that degree affecting the just and legal rights of the corporation of Pembroke. This point I desire to draw particularly to your attention, as on this basis alone is this report submitted, and on the same basis must all negotiations be conducted or actions taken by yourselves or by any other duly authorized representative of the corporation, whether negotiating with the company regarding an extension or continuation of its contract, or whether concerning the purchase and installation of a corporation plant.

The estimates herewith submitted show, firstly, the cost of purchasing and installing an electrical plant as part of the waterworks plant now owned by the town, this electrical plant to be capable of supplying both street and private illumination services of sufficient extent to meet the probable requirements of the town, with provision for an increase in capacity should such be made necessary through a considerable increase in population ; and, secondly, the approximate cost per annum of thirty arc street lamps of 2,000 nominal candle power each, the approximate cost per lamp per annum of 16-candle-power incandescent lamps for house and store illumination, both services operated in conjunction with the water-works system, and finally, the approximate charges necessary to be asked for private illumination service in order that the revenue therefrom may be sufficient to provide free street lighting and at the same time cover all expenditure in connection with the incandescent system. Your attention is respectfully called to the fact that the estimate of cost of installing the street lighting plant includes an ultimate capacity for fifty lamps of 2,000 nominal candle power, and further provides for the adoption of a much more economical type of lamp than the one now in use on the streets of many towns and cities, and one capable of furnishing a much more satisfactory, better diffused, and steadier illumination than can be furnished by the older type.

Your attention is further called to the fact that the estimate of operating expenses and approximate necessary revenues is based on the operation of the electrical plant as part of the water-works system, which necessarily places the municipal electrical plant at a considerable advantage over that of the company, owing to the possibility of eliminating and dividing certain expenses among the street, private incandescent, and water-works systems.

Where no industrial system or service has already been established in a municipality, and that municipality desires to undertake to supply itself with any or all of these services, the question of control or ownership, private or public, can of course be more easily dealt with, but in the case of Pembroke, where we find that a private plant has already been installed and is now in operation as any other commercial enterprise, controlled by, and therefore involving more or less, private capital, justice demands that the owners thereof shall receive due consideration, such consideration, however, to be secondary to that due the majority of tax-paying citizens as a whole.

While the estimates given show approximately, and within as close a degree of accuracy as can be, what the town can do for itself in the event of installing and operating a municipal plant, it must be borne in mind that the same plant or system under private control cannot reasonably be expected to supply illumination for the same relative cost to the taxpayer, on account of requiring a larger staff of employees, hence heavier operating expenses, and, having as well to fulfill the intention for which the system is created, namely, payment of dividend on the capital invested therein. In view of the fact, therefore, that vested interests demand fair consideration and an opportunity for self-protection in your town, the following advice is respectfully offered, in the full belief that your hearty co-operation in it will be assured so long as there is a reasonable chance of the interests of the citizens as a whole being properly protected :—

I would advise : Firstly, that the Pembroke Electric Light Co. be asked to confer with your honorable body at some mutually convenient time, with a view towards eddeavoring to come to an understanding along the lines concerning the rates for incandescent lighting for private consumers, as described under Estimates of Operating Expenses, sec. (c), Combination Services, sec. (d), Rates and Revennes ; and, further, with a view toward arriving at some definite annual charges for street lighting, at so much per given candle power of lamp per annum, both street and private rates to be compatible with the payment of a reasonable dividend, (specific), on that amount of capital actually necessary to install the same capacity in a municipal plant, together with the bona fide operating expenses of a municipal system having therein the highest efficiencies obtainable in electrical, steam, water-power, transmission and translating devices, such as generators, engines and boilers, water-wheels (if water-power be adopted), distribution lines, transformers, and arc lamps. In connection with the subject of bona fide expenses, I would advise your insisting, with all due deference to the company, that all books, office records, vouchers, etc., in relation with the actual operation of the system be constantly accessible to the duly authorized representatives of the corporation. Secondly, that the company be required to enter into an agreement in proper form, with the corporation, concerning the basis on which future charges shall be calculated as the demand for lighting increases throughout the town, during the term of the agreement or contract.

I would further advise that the corporation guarantee the company a full and absolute protection from other competition, municipal or private, during its faithful compliance with the terms and conditions of the agreement, this protection to be guaranteed through the contract covering a period of not less than five years, nor more than ten years.

In order that the circumstances surrounding the respective positions of the corporation and the company may be the more readily understood and appreciated by yourselves, the company, and the citizens, the following considerations must be allowed their full value in each case :

(1). Any municipality has an equal right with the private purchaser or consumer to obtain the supply of any commodity or article having a commercial value, from that source which can or will supply such article at highest attainable quality and lowest cost to the purchaser.

(2). A municipality, having the right and power to not only purchase its industrial services and supplies from the most reliable, convenient, efficient and economical sources, but to undertake to supply itself with such services under municipal ownership and control, thereby affording to its citizens, under proper management, a service at lower cost than that afforded by the privately owned system, would most certainly be unlikely to knowingly choose the more expensive source of supply. Therefore, if it grant protection to a private enterprise, allowing it to exist as a monopoly within the limits of the municipality, it has every legal right to insist on being supplied with a service as efficiently and as economically as can possibly be obtained through any other private source or system operating under similar circumstances or comparative conditions. The private enterprise accordingly owes its existence in a very large measure to the good will of a majority in the municipality. If the private company will not supply the best services obtainable under the existing conditions, or under remedied conditions, and at the lowest consistent cost to the consumers compatible with a fair return on the capital invested, then the municipality can with justice take such action toward bettering the conditions as it may deem advisable, whether by cancelling all rights and privileges accorded the company and granting a franchise to any other company or body capable of and willing to undertake such supply, or by entering into the manufacture and sale of the service on its own account.

The corporation of Pembroke has, therefore, a legal right to deal as may seem best with the Pembroke Electric Lighting Company in the interests of the citizens as a whole. If the company will

not enter into a fair, just and equitable contract with the corporation, after being allowed every opportunity for so doing at the hands of your honorable body, it should be evident to every fair-minded citizen of Pembroke that you can only proceed to discharge your duty to those for whose interests you are acting by arranging for the purchase and installation of a municipal lighting system. As I have already advised, it will be more in the interests of justice to all concerned to endeavor as far as possible to deal with the company, at the same time showing your willingness to grant favorable terms and conditions in return for equally good faith on the part of the company. If the company, after due negotiations, will not enter into a fair agreement with the corporation—an agreement which can be proven by a disinterested authority to be practicable to both sides—the choice as to the next action to be taken in the matter of obtaining a better and more efficient lighting system will have to remain for yourselves to decide.

INSALLATION COSTS.

1. Street Lighting Service (Capacity, 50 Arc Lamps, 2,000 c.p., of improved type):

(Estimate calculated without regard to any other electrical plant, such as private lighting, etc.)

Arc Generator, capable of supplying fifty 2,000 c.p. lamps..	$2,000
Arc Lamps, suitable for street service (30 installed)	900
Arc Distribution Wiring, including cost of placing on poles	1,950
Poles installed for entire arc circuits, @ $3 each set......	960
Steam Engine—high speed—to be installed in W.W. station	800
Boiler Plant—present boilers can be used to advantage.	
Foundations, for generator and engine, including addition to present waterworks station....................	2,100
Belting, including other accessories to steam plant........	130
Incidental expenses, including engineering supervision...	1,200
Approximate total cost of plant installed complete..	$9,140

2. Private Lighting Service (Capacity, 2,500 16 c.p. lamps).

(This estimate calculated without regard to any other electrical plant, such as street lighting system, etc.)

Alternator, capacity 2,000 to 2,500 lamps, installed.......	$4,000
Transformers, sufficient for the first two years' supply....	1,000
Incandescent Lighting Distribution, including poles set...	8,800
Steam Plant, slow-speed engines, condensing, highest quality, including countershafting and belting, installed	6,500
Foundations and Lighting Station Building, ext'n to W.W.	4,000
Incidental expenses, including engineering supervision...	1,687
Approximate total cost for separate incand'nt plant,	$25,987

3. Combined Installations :

By combining the street and private lighting plants under one roof and management, the costs of installing can be materially reduced. Under the same combination the costs of operating can be very considerably reduced.

Arc and Incandescent Plants installed as one whole system, all in complete running order and comprised of materials of the highest obtainable quality and durability, and machinery of highest efficiencies, including addition or extension to permit waterworks pump-house to accommodate electrical plant, can be purchased and installed at a cost not exceeding	$30,000

OPERATING EXPENSES.

(a). Street Arc Lighting (2,000 c.p. lamps) :

This estimate is calculated on the basis of the streets being illuminated by fifty arc lamps of 2,000 nominal candle power each, from dark of moon until daylight, every night in the year, and including cloudy nights which would otherwise come under the moonlight schedule. The estimate is further based on the adoption of the latest, most approved, and most economically operating and proportionately small expense for trimming and attendance, the plant to be operated in conjunction with the waterworks system.

Interest, on cost of plant, 5% per annum..................	$457
Depreciation, on cost of plant, 5% per annum............	457
Carbons and Trimming, Attendance, etc.......	500
Fuel (wood at $1.50 per cord, delivered)................	900
Contingencies (oil, waste, repairs), ample allowance, annual	600
	$2,994
Total cost per annum for 50 lamps of 2,000 candle power,	$2,994.00
Annual cost per 2,000 candle power lamp..	59.88

(b) Private Incandescent Lighting (2,000 16 c.p. lamps) :

This estimate is calculated on the basis of a very probable demand during the first years of operation, of not less than 2,000 lamps of 16 candle power each. Also, that the plant be operated in conjunction with the waterworks system, but without regard to street lighting. Highest qualities and efficiencies of apparatus used throughout.

Interest, on cost of plant, 5% per annum.............	$1,499.35
Depreciation, on cost of plant, 5% per annum........	1,499.35
Fuel (wood at $1.50 per cord, delivered)	1,350.00
Labor and Attendance (2 men, at $600 and $360).....	960.00
Contingencies (oil, waste, repairs), annual allowance ..	600.00
	$5,908.70
Total annual cost for 2,000 lamps of 16 c.p...........	$5,908.70
" " one lamp "	2.96

(c). Combined Public and Private Services :

This estimate is based on the operation of the street and incandescent lighting plants as one system, in conjunction with the waterworks plant, under the one staff of employees, sufficient for all practical purposes. Owing to larger steam units required for the combination plant, the consumption of fuel can be very materially reduced through the adoption of engines and steam generating plant of higher efficiencies. The interest on the combined costs will also be below that of the total cost of two separate plants.

Interest on combined cost, $30,000 @ 5% per annum......	$1,500
Depreciation on combined cost, $30,000 @ 5% per annum	1,500
Carbons for arc lighting plant, @ $35 per M.	160
Fuel for two plants—compound condensing engines......	1,600
Wages—2 men. Lamp trimmer dispensable on account of enclosed type arc lamp, requiring trimming 4 times per month. Assistant can easily attend to lamps. Wages at rate of $600 and $360 per annum.........	960
Contingencies, under combined operation, annual........	900
	$6,620
Total cost per annum, 2 plants under combined operation,	$6,620

(d). Rates to Consumers and Approximate Revenues.

The following schedule shows approximately the charges necessary to be exacted for private incandescent lighting in order to cover operating expenses of that system, and at the same time afford free street lighting to the corporation :

	Per Lamp per Annum.
Average rate with 2,000 incandescent lamps in use....	$3.30
" " 2,500 " " "	2.80
" " 3,000 " " "	2.40

The above rates are approximate, but correct within 10 per cent. As the operating expenses do not increase in direct proportion to the number of lamps in use, the greater the number of lamps used in the one plant the lower the price per lamp until that point of demand is reached whereby an increase in capacity of plant and number of attendants is required. Hence the rates to users of incandescent lamps can be proportionately reduced so that the service can be placed within reach of every citizen, and yet the revenue therefrom will always be amply sufficient to afford free street lighting besides covering the private lighting operating expenses. It is on these lines that the negotiations with the Pembroke Electric Light Company should be conducted, particularly with a view toward securing for the majority of the citizens who cannot afford to use the private lighting service at the present rates, a price so that all can ultimately obtain some practical personal benefit from the system which they are now protecting through the medium of the company's franchise.

MOONLIGHT SCHEDULE FOR JANUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 5.10	P.M. 10.30	5.20
2....	" 5.10	" 11.30	6.20
3....	" 5.10	A.M. 12.30	7.20
4....	" 5.10	" 1.30	8.20
5....	" 5.10	" 2.40	9.30
6....	" 5.10	" 3.50	10.40
7....	" 5.10	" 4.50	11.40
8....	" 5.20	" 6.00	12.40
9....	" 5.20	" 6.20	13.00
10....	" 5.20	" 6.20	13.00
11....	" 5.20	" 6.20	13.00
12....	" 5.20	" 6.20	13.00
13....	" 6.30	" 6.20	11.50
14....	" 7.40	" 6.20	10.40
15....	" 8.50	" 6.20	9.30
16....	" 10.00	" 6.20	8.20
17....	" 11.00	" 6.20	7.20
18....	" 11.10	" 6.20	7.10
19....	"	" 6.20	6.10
20....	A.M. 12.10	"	
21....	" 1.20	" 6.20	5.00
22....	" 2.20	" 6.20	4.00
23....	" 3.20	" 6.20	3.00
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	No Light.	No Light.	.....
27....	No Light.	No Light.	.....
28....	P.M. 5.40	P.M. 8.20	2.40
29....	" 5.40	" 9.20	3.40
30....	" 5.40	" 10.20	4.40
31....	" 5.40	" 11.20	5.40
		Total....	213.30

SPARKS.

Mr. C. E. Nailor, of Essex, Ont., intends putting in a new incandescent electric light plant in his flour mill.

Mr. W. T. Douglas has resigned his position as manager for the Bell Telephone Company at Stratford, Ont.

The business men of Baldur, Man., are considering the advisability of constructing a telephone system for the town.

At Prescott, Ont., the by-law to raise $15,000 for a municipal electric light plant was carried by a majoriy of 37 votes.

The village of Forest, Ont., defeated two by-laws, at the municipal election, providing for the establishment of a municipal electric light plant.

The citizens of Ottawa, Ont., have declared in favor of a Sunday street car service. The result of the vote was 4,628 for and 1,664 against.

It is announced that the Richelieu & Ontario Navigation Co. purpose placing an electric light plant and boiler in the steamer "Saguenay" this winter.

The ratepayers of St. Thomas, Ont., have voted down the by-law to provide funds for the installation of an electric light plant, to be operated under civic control.

It is said that representatives of the Toronto Railway Co. were recently in Whitby in connection with a proposal to extend the system to that town and Oshawa.

A by-law to authorize the city council of Winnipeg, Man., to install a municipal electric light plant, at a cost of $50,000, was voted down by the ratepayers last month.

The efforts of certain citizens of Nelson, B. C., to have the electric light by-law declared invalid have been defeated. The Electric Light Co. will, therefore, get $35,000 for their plant.

Mr. Thomas A. Low has secured an option on the water power of the late M. L. Russell, at Renfrew, Ont. It is said that the town may purchase the power and establish an electric light plant.

Municipal control does not seem to have been a success in the town of Richmond, Que., as we observe that the corporation is offering for sale their dam, water-wheels, dynamos, machinery, etc.

The John R. Scott Co., of Napanee, Ont., are increasing their plant by putting in another "New American" water wheel, which will give them 500 horse power. The company intend to extend their line to Arthur and Colebrook next spring.

Messrs. Daly & Hamilton, of Rossland, B.C., are asking for the incorporation of the British Columbia Electrical Supply Co., Limited, to supply electric light, heat and power, and construct railways, telegraph and telephone systems, and other works.

The W. A. Johnson Electric Company are installing an alternating plant for the corporation of Acton, Ont., including 55 street lamps and all wiring for the town. The generator will be one of their inductor type alternators, which are meeting with much success.

At the next session of the Ontario legislature a company will seek incorporation as the Haliburton, Whitney and Mattawa Railway Company, with power to build a steam or electric railway from a point on the G. T. R. at Haliburton to Whitney and Mattawa.

Letters patent of incorporation have been granted to the Metropolitan Electric Co, of Ottawa, with a capital of $500,000. This company, as mentioned previously, are developing a water-power at Britannia, and purpose supplying light and power throughout the city of Ottawa.

The Grand River Electrical Power Co. has been organized by Messrs C. H. Carroll, J. F. Boltbee and A. N. Parney, of Paris, and W. J. Clark and Thomas McLaughlin, of Toronto. The capital is $90,000, and the company have power to supply electric light, steam, heat, and natural gas.

The directors of the Hamilton, Chedoke & Ancaster Railway will apply to parliament for an amended charter, giving them power to build a line to Brantford, to change the name to the Hamilton, Ancaster & Brantford Electric Railway Co., and to increase the capital stock from $100,000 to $200,000.

A son of Mr. William Williams, manager of the Gas & Electric Light Co., Sarnia, Ont., had a narrow escape from suffocation by gas recently. He had descended into a trench to examine a break in the main when he was overcome by the fumes of the gas. Fortunately, his condition was observed by his fellow workmen.

Mr. R. Weddell, who owns a controlling interest in the Trenton waterworks, is at present negotiating for an amalgamation of the electric light and waterworks companies there, with a view to increasing the power plant so as to operate both and supply power to manufacturers. It is also proposed to light the city of Belleville, 12 miles distant.

The electric light plant at Granby, Que., is now partly in operation, and will soon be entirely completed. A pair of 30 inch Crocker wheels are being untilized at present, plenty of water being available, while the 250 h.p. Corliss engine is being set up. The whole plant is modern, and the arrangements reflect credit on the Jenckes Machine Company, contractors for the plant equipment.

The Alliston Electric Light Company, of Alliston, Ont., are making changes in their lighting station, and have decided to increase their incandescent lighting capacity. For this purpose hey have placed their order with the Royal Electric Company for one of their 60 k.w. "S.K.C." two phase machines, from which they will serve both arc and incandescent lights as well as power, which has heretofore been served by both machines.

A syndicate, at the head of which is Mr. George Skead, the original discoverer of Lake Girard mica mine, is engaged in opening up a new mining district on the Big Blanche river, near Thurso, Que. The syndicate have secured several thousand acres of mining land in that vicinity, and are now taking out about five tons of culled mica per week. Associated with Mr. Skead are Messrs E. A. Blakeney and H. K. Lee, of Ottawa.

Mr. Alex. Pushle, an engineer of the Dominion Coal Co., of Cape Breton, has gone to South Africa, where he will superintend the experiment of using the patent fuel manufactured in Cape Breton on locomotives and for general steam purposes. About two months ago 250 tons of this coal were shipped to South Africa by the Dominion Coal Co. If found satisfactory, an extensive field will be opened up for the waste product of the coal mines of Cape Breton.

The Jenison by-law was carried by the ratepayers of Port Arthur, Ont., on the 2nd inst. By this the town agrees to pay Mr. E. S. Jenison the sum of $10,000 per annum for 40 years for 750 electric horse power and 250,000,000 gallons of water per year. The scheme, already familiar to our readers, involves the construction of a canal from Kakabeka Falls to Port Arthur. This canal, it is said, will develop 20,000 horse power, and have a head of water at Port Arthur of 300 feet.

The Canadian, British Columbia & Dawson City Telegraph Company, Limited, has been formed, with a capital of $1,500,000, to construct a telephone system to the mining districts of the Yukon river. The directors of the company are: Sir James Grant, K.C.M.G., Ottawa; Sir Adolphe Caron, K.C.M.G., M.P., Ottawa; J. H. Turner, M.L.A., ex-premier British Columbia; Ald. John Hyde, of Banbury; W. H. J. Fawcus, director Edison & Swan United Electric Light Co., Limited, Dartmouth House. W. Young, 64 Victoria street, London, is the secretary.

According to the London Electrical Review, one of the most novel systems of electric canal towage that has yet been tried is meeting with such great success that the line is to be extended some fifty miles. Small track tricycles, equipped with six horse power motors, run along a French tow-path, taking their current from an overhead wire. These are sufficiently powerful to draw a 300 ton boat at a speed of 1.5 miles an hour. While the system is not cheaper than animal haulage, yet the speed is greater and the service very regular. There are two generating plants, each of 200 horse-power, one at each end of the line.

Tenders for the proposed electrical power transmission plant at Orillia, Ont., were opened by the council a fortnight ago. For the electrical machinery three tenders were submitted, from the Canadian General Electric Company, Toronto, Royal Electric Company, Montreal, and Westinghouse Electric & Manufacturing Company of Pittsburg, Pa., through the Central Construction Company of Buffalo, N. Y. For the transmission line supply and construction, tenders were submitted by the Canadian General Electric Company, Central Construction Company, and C. H. Patriarche, contracting electrical engineer, Toronto. Three tenders were also submitted for the hydraulic machinery and construction, from William Kennedy & Sons, of Owen Sound, Ont., Central Construction Company, and P. H. Patriarche. No decision has been reached as yet, but it is believed that the council favor the tenders of P. H. Patriarche, for the whole equipment, including electrical apparatus of the Royal Electric Company's manufacture, at $66,680, and the Central Construction Company, of Buffalo, including Westinghouse electrical apparatus, at $67,200.

SPARKS.

Some of the residents of Thessalon, Ont., are in favor of taking steps to introduce the electric light.

The capital stock of the Imperial Oil Co., Petrolea, Ont., has been increased from $500,000 to $1,000,000.

A project is on foot to build an electric railway between Trenton and Westville, N.S., via New Glasgow and Stellarton.

The merchants of Souris, P.E.I., are considering the advisability of having the town lighted by electricity. Oil lamps are now used.

Mr. J. M. Clark is a farmer just outside the town of Smith's Falls, Ont., who has just had his buildings wired for electric light.

The town of Barrie, Ont., has entered into an agreement to take over the plant of the Barrie Electric Light Co., at the price of $22,501.

Mr. Thomas Chater, chief engineer for the Windsor Electric Light Co., Windsor, Ont., was caught by a shaft and slightly injured recently.

The by-law to raise $5,000 for the extension of the electric light plant at Thorold, Ont., was defeated by the ratepayers at the municipal elections.

The first narrow gauge railway train operated by electricity in Europe was given a trial on a short road between Dusseldorf and Kerfeld, Germany.

The C.P.R. steamship fleet will receive a general overhauling at Owen Sound, Ont., during this winter. An electric light plant will be installed on the "Alberta."

The Wallaceburg Electric Light Co., of Wallaceburg, Ont., has been granted an extension of time to February 1st, for the installation of an incandescent lighting plant.

At a meeting of the directors of the St. Catharines Electric Light Co., held on December 30th, it was decided to add to the plant a new engine and boiler, at a cost of $6,000.

The Lake Megantic Pulp Company, of Lake Megantic, Que., will ask the government for an increase of its powers, with a view to supplying electric light and power and constructing tramways.

The first annual dinner of the employees of the Winnipeg Street Railway was held in Winnipeg on January 2nd. In order that most of the employees might attend, the dinner was held at midnight.

The electric light plant at Stanbridge East, Que., will be in operation in a few days. The feeder pipe for water wheel is now being laid in, and the Crocker turbine, furnished by the Jenckes Machine Company, of Sherbrooke, Que., has arrived.

Tenders for the electric wiring for the new city hall at St. Thomas, Ont., were received as follows: Rogers & Co., London, $395; H. L. Gray, Toronto, $409; Matthew Stearns & Son, St. Thomas, $568. The tender of H. L. Gray was accepted.

It is reported that the widow of the late John W. Keeley has entrusted to a former Canadian, in the person of Mr. T. Burton Kinread, late of Moncton, N. B., the task of completing and perfecting the Keeley motor. Mr. Kinread is now located in Boston, Mass.

Mr. Charles MacBeth has established business in the Masonic Temple building, London, Ont., under the name of the Ontario Electric Company. The new firm will keep in stock a supply of electrical apparatus, and will give special attention to electric wiring.

The electric lighting plant recently sold to the corporation of the town of Campbellton was started up for Christmas lighting. The driving power is water, and the electrical apparatus is of the Royal Electric Company's "S.K.C." two phase type, for arc and incandescent lighting and power.

The Niagara Falls Park & River Railway Co. have brought action against the town of Niagara Falls, Ont., to recover the sum of $124.42, paid as taxes by them to the corporation on a $6,000 assessment on their roadway. The company claim that the property is a public highway, and therefore exempt.

The Chicago Record states that the Count de Jotemps, of Jaris, France, has closed a contract with the Fischer Equipment Co., of Chicago, under which the latter agrees to furnish 500 horseless vehicles each year for the next ten years. It is also said that the count has closed other contracts for 1,500 vehicles.

The General Electric Co., of Schenectady, N.Y., has received an order from the company which is constructing the underground street railway in Paris, for eight electric locomotives and necessary equipment. The locomotives will be of the same type as those or the Central London Underground Railway. The length tne Paris road is three miles.

The Gendron Manufacturing Company, of Toronto, recently decided to install a direct-connected 600 light generator for lighting their factory. The order was placed with the W. A. Johnson Electric Company for a generator and the wiring of factory. They will use a 10 x 10 Ideal engine, manufactured by the Goldie & McCulloch Company, of Galt, Ont.

The corporation of Beeton, Ont., recently decided to install an electric light plant. It was put in about two months ago, and since then the number of lights has increased to nearly the capacity of their present machine, which is one of the W. A. Johnson Electric Company's inductor type of alternator, suitable for a plant where a repair shop is not near by.

The council of the town of Dartmouth, N. S., will ask power from the provincial legislature to issue $150,000 of bonds for the purpose of operating a street railway in Dartmouth and vicinity. A bill will also be submitted empowering the issuing of bonds to the amount of $50,000 to establish an electric light plant for lighting the streets and public buildings.

The Wallaceburg Electric Light Company, of Wallaceburg, Ont., have been supplying arc lights for the town of Wallaceburg for a number of years. Now they have decided to go into the incandescent lighting business, and have placed their order with the Royal Electric Company for a 30 k.w. alternator and 900 light capacity in "S.K.C." transformers and material.

A rumor has been current that the street railway at Sherbrooke, Que., had been purchased by Messrs. Frank Thompson & Co., financial agents of that city. This company is said to have secured the Brompton Falls water power, and to have decided to proceed at once to extend the line to North Hatley and other points. The report, however, has not yet been confirmed.

The ratepayers of the city of Hull, Que., carried a by-law on January 2nd to raise $8,000 for the installation of an electric light plant for street and city lighting. The plant will incude two 50-light dynamos, seventy-five 1,200 c.p. arc lamps, and some eight miles of line. Tenders for same will be invited and the work proceeded with at once. The city owns a suitable water power, which will be utilized for the purpose.

At the ensuing session of parliament, Mr. George E. Kidd, of Ottawa, acting for a syndicate, will apply for a charter incorporating a company to construct a steam or electric railway from the city of Ottawa to Meach's Lake, with branches to Graham's Bay, Aylmer and Hull. Should a charter be granted, the work of construction will be commenced in the spring. The capital stock of the company is placed at $500,000.

Mr. Percy Domville, of Hamilton, Ont., has presented to the city council of St. Thomas, his report on the cost of installing a civic lighting plant. His estimates for 100 arc-light plant are as follows: Steam plant, $7,550; electric plant, $13,571.50; buildings, $9,300; duplication of plants, $8,000. For installing in connection therewith an incandescent plant of 3,000 lights the cost is given as follows: Steam plant, $9,550; electric plant, $18,225.

There is an arrangement between the Dominion government and the street railway companies operating in most of the large cities in Canada, by which the letter-carriers use the street cars in the performance of their duties. For this consideration the Montreal Street Railway Co. have been paid the sum of $200 per month, but the Postmaster-General was notified some time ago that the service would not be continued upon this basis. The company claim that a record of the work performed shows that at regular fares the sum to be charged would be over $1,000 per month, and hence their refusal to renew the contract on the former terms. In Toronto the price paid is said to be $400 per month.

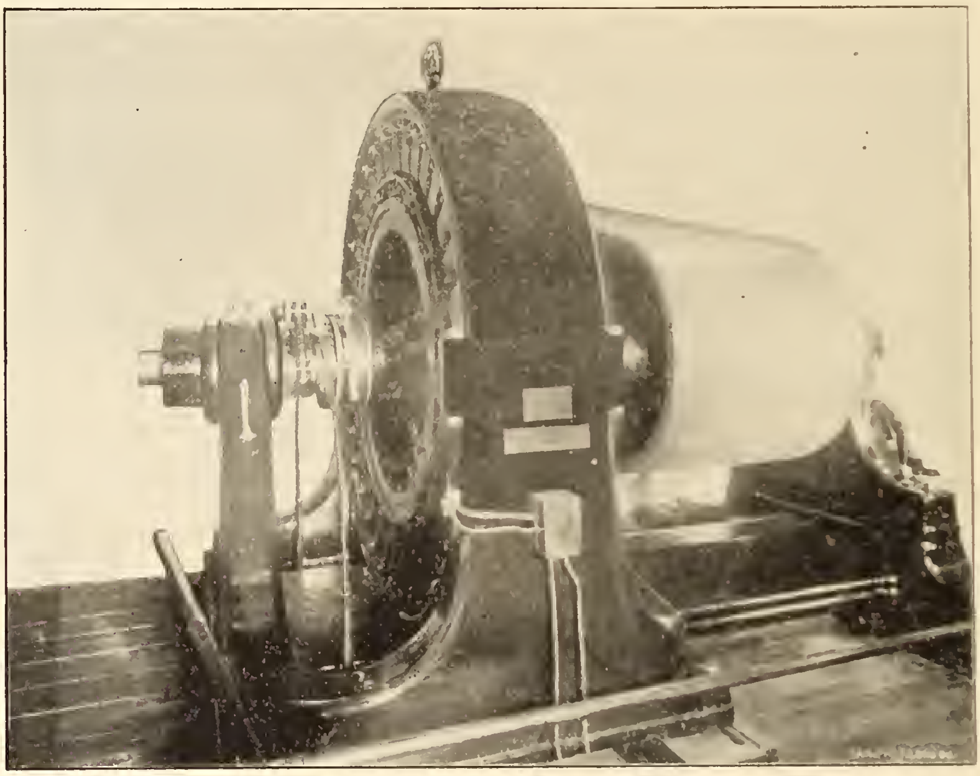
In the December number of the Street Railway Journal, of New York, appears an article by Mr. William Banks, of the Toronto Railway Co., dealing with the methods of increasing street railway traffic. After referring to the necessity of creating traffic by establishing parks and other places of amusement, Mr. Banks says: "This city has an extensive water front and a beautiful island summer resort within the city limits, and it is anticipated that at no distant date boat trolleys will be placed in operation along the water front by our company to carry passengers to and from and around the island." Mr. Banks describes methods of co-operating with steam railways and boats to handle excursion parties and people arriving to attend unusual entertainments,

LARGE ELECTRIC LIGHT DYNAMO.

THE illustration on this page represents what is claimed to be the largest dynamo which has yet been installed in Canada for electric lighting service. It is one of the latest type of Westinghouse alternators, and was installed in the power house of the Ottawa Electric Company by Messrs. Ahearn & Soper, of Ottawa, Canadian agents for the Westinghouse Electric & Manufacturing Company.

The voltage is 1,200; alternations, 16,000; speed, 445 r.p.m.; capacity, 420 k.w.; weight (alternator and exciter together), 33,500 lbs. A particularly noticeable feature of the machine is its low temperature. It was guaranteed to deliver 420 k.w. continuously at a temperature rise not exceeding 40° C. The test made by the Ottawa Electric Co. gave 488½ k.w. on a ten-hour run, with a temperature rise of only 11° C.

The field poles of Westinghouse alternators are built up of thin sheets of steel and then placed in the mould, and so cast into the cast iron yoke or field frame. In this way the field poles are constructed of the best possible material, an extremely powerful magnetic field being secured, while the losses due to eddy currents, which are sometimes very serious where solid field poles are used, are eliminated by the use of the laminated poles. The armature is absolutely iron clad, and can be readily handled without danger of damage to the winding. The construction is such as to facilitate insulation against high potentials, while in case of accident coils may be removed and replaced without difficulty.



LARGE ELECTRIC LIGHT DYNAMO.

COMPARATIVE COSTS AND PROFITS OF CABLE, ELECTRIC AND HORSE CAR OPERATION.

SOME interesting figures are published in the Street Railway Journal showing a comparison of the relative cost of operation of the cable, electric, and horse-car systems of the Metropolitan Street Railway Company of New York. The data was obtained from the private cost sheets and other records of the company, and covers a period of twelve months, ending June 30, 1898. The experience of the Metropolitan Company points unmistakably to the great superiority of electricity over both horses and cable, not only in traffic handling capacity, but in economy.

The relative traffic densities measured by the receipts per mile of track and per car mile as shown in one-quarter's report are as follows: Cable, $39,000 per mile of track and $.333 per car mile; electric, $17,000 per mile of track and $.260 per car mile; horse, $8,000 per mile of track and $.288 per car mile. The average earning power of the entire system was about $14,000 per mile of track and $.29 per car mile. These figures are for one-quarter only.

It is shown that 11% of the company's entire mileage which is operated by the cable system is earning 28% of the total passenger receipts; the 28% which is operated by the electric system is earning 32% of the total passenger receipts, and the 61% which is operated by horses is earning but 30% of the total passenger receipts. For the year, the operating expenses of the cable line were 16.424 cents per car mile, of the horse lines 17.87 cents, and of the electric lines 10.23 cents. The electric lines during the twelve months earned 16.67 cents net per car mile, or but 1.25 cents less than the cable system, in spite of the fact that the latter has 7.434 cents per car mile greater receipts.

From a careful study of the figures, it is believed that were all the lines in New York city to be equipped with a single motive power, electricity would have a permanent advantage over the cable of at least 3.05 cents per car-mile in maintenance of way, a slight disadvantage in maintenance of equipment, and an advantage of at least 1.25 cents in power, of 1.5 cents in transportation, and of .5 cent in general expenses—a total of nearly 6.75 cents per car mile. In comparison with horse traction, electricity would be at a disadvantage of perhaps .5 cent per car mile in maintenance of way and .5 cent in maintenance of equipment; while it would have an advantage of at least 6 cents in motive power, 1.5 cents in transportation and 5 cents in general expenses—a net difference of 7 cents. Besides this, electric cars would earn more than either horse or cable cars with equivalent mileage.

In the transportation expenses it was found that electric traction is the cheapest of the three motive powers, the reason for this being in the greater speeds of cars possible with electric traction. In every division of operating expenses electricity has a decided advantage over the cable system, and in every division except maintenance of equipment it has an advantage over the horse system. During the twelve months' period the cable lines operated at 47.7 per cent. of their passenger receipts, the electric lines at 37.0 per cent., the horse lines at 65.3 per cent., and the entire system at 53.3 per cent.

AN INTERNATIONAL ELECTRIC RAILWAY

THE Niagara Falls Park & River Railway has the honor of operating the first international electric railroad between the United States and the Dominion of Canada. This notable line is run across the greatest steel arch bridge in the world, which spans the Niagara Gorge at Niagara Falls, very close to the great cataract. The line has a double track, and the cars that are operated on the bridge connect at the Canadian end with the cars of the road running between Chippewa and Queenston, along the top of the high bank on the Canadian side of the river. On the bridge the centre pole system is employed, and the cars speed across the structure every few minutes. Under the present arrangement the bridge tickets purchased by strangers allow them the use of the trolley cars; that is, they ride free if they so elect. Residents of Niagara Falls who pay ten cents for crossing the bridge are forced to pay an additional five cents to ride in the cars, making the price for crossing the bridge in the cars fifteen cents for both strangers and residents. The power for operating the cars on the bridge is supplied from the railway company's power station in Queen Victoria Free Park. This crossing of the steel arch by the Niagara Falls Park & River Railway, places it in close business touch with the crowds of people in both of the great free parks at Niagara—the New York State reservation on the one side and the Queen Victoria Niagara Falls Free Park on the Canadian side. It is reasonable to suppose that all the people who go to Niagara sight-seeing go to these beautiful parks, and therefore the advantages of the road for catching travel are extremely good. Then again, the New York State end of the line is right at Prospect Park, and its cars afford rapid transit between the free parks. The cars now run right up to the Riverway, a street within the limits of the New York State reservation. In time it is expected that connection will be made between the Niagara Falls Park & River Railway and some line on the New York State side, either the Niagara Falls & Suspension Bridge Railway Company or the Buffalo & Niagara Falls Railway, which could be accomplished by the construction of a few hundred feet of track up to Niagara street and across the Riverway to the tracks of the Niagara Falls Park & River Railway Company.

The Winnipeg Electric Railway Co. will be requested by the council to equip their cars with fenders.

It is understood that M. F. Beech & Co., of Winchester, Ont., purpose putting in a larger dynamo in their factory.

The Cataract Power Company of Hamilton, Ont., is understood to be considering the construction of an electric railway to Guelph and Berlin.

The Montreal Street Railway Company has made application to the provincial legislature for permission to increase its stock from time to time and to authorize the extension of its lines to any point within ten miles of the city of Montreal.

Messrs. Nesbitt, Gault and Dixon, solicitors, will apply to the provincial legislature for an act to incorporate the Hamilton and Caledonian Railway Company, to build an electric railway from St. Catharines to Caledonia and Selkirk.

About 100 employees of the Quebec Street Railway, the Quebec, Montmorency & Charlevoix Railway, and the Montmorency Electric Power Company, have formed an athletic association, with Mr. E. F. Wurtelle as president, and Mr. L. D. Joncas, jr., as Secretary.

PUMICE STONE IN STORAGE BATTERIES.

It has long been the desire of electricians to perfect a practical storage battery, but of all the different systems that have been devised since the days of Faure and Plante, each and all have presented internal infelicities which have prevented their coming into general use, much as they have been desired. The Germans, however, have made a long step towards solving the problem of a practical storage battery, and one factory now in Germany turns out fifty tons of batteries per day. One of the most ingenious innovations in the storage cells has been the admixture of granulated pumice stone with the lead from which the storage plates are to to be molded. The heat from the molten lead expands the air contained in the pores of the pumice stone, and in this way an infinite number of cells are formed throughout the mass of lead. The porosity thus obtained is so great that a plate 9 x 7½ inches will absorb five and one-half ounces of water. If desired, the pumice stone can be removed at will, but as a matter of fact, being electrically inert, and as there is but 10 per cent. of solid matter, its presence is of little account either one way or the other. By this method an enormous range is available, both in the elements of weight and porosity. It is hoped that by the use of this spongy form of lead a return may be permitted to the earlier and simpler Plante type of cell, which of late has given way to the Faure system, in which the active material is mechanically applied to the plate. The new spongy cell has a large natural surface of "active material," whether the plates be thick or thin, and it is held with absolute security in the innumerable pockets of the body of the plate. The use of pumice stone is certainly a most ingenious application of means to an end.—Stonemason.

CLEANING THE GLOBES OF ENCLOSED ARC LAMPS.

In an article in the Electrical World, Mr. J. H. Hallberg remarks that the trimming and cleaning of the inner globes on enclosed arc lamps is of the utmost importance, as the efficiency and candle power depend, to a large extent, on the transparency of the inner globes. It will be found that most of them are covered inside with a grey-white dust, or film, which comes off if the globe is washed in clean water ; but some, even if they are washed in water, show a brown-black stain around the top of the globe which apparently will not come off, no matter how much it is washed ; in fact, it appears as though it were a natural color in the glass itself. This is due to several causes. The most common is the impurity of the carbons, which contain too much metallic material ; another is too great a length of the lower carbon, which brings the arc too near the neck of the inner globe ; or the cause may be too much current flowing across the arc, especially during the few minutes after trimming the lamp with new carbons, this causing an excessive flame that gets in contact with the globe, and in that way stains it. The only way to clean a globe in this condition is by dipping the burned part in hydrofluoric acid. This acid is very dangerous to handle, and much care should be exercised when it is used. As this acid will eat through almost every material except lead and wax, it must be kept in a jar of either of those materials. Mr. Hallberg prefers lead, as the acid gets warm when it acts on the glass, and he has seen cases where the wax melted and let the acid run out.

PERSONAL.

Mr. J. H. Meikle, electrical engineer of Willoughby's Consolidated Company, Buluwayo, South Africa, is on a visit to his home in Morrisburg, Ont.

Mr. Burgess, engineer at the electric light plant, Toronto Junction, Ont., is at present visiting friends in England, having been granted leave of absence by the council.

Mr. John Rowley, superintendent of the Belt Line Railway, Montreal, has been appointed manager of the Bout de l'Isle hotel, which has recently been taken over by the Montreal Belt Line Railway Company.

The employees of the Chambers Electric Light and Power Company, Truro, N. S., evidenced the good feeling existing between them and their manager, Mr. S. G. Chambers, by presenting him with a gold-headed cane, accompanied by a complimentary address, as a Christmas gift.

Mr. P. F. Hodgson, chief signal engineer of the Grand Trunk Railway, recently resigned his position to go to England, and has been succeeded by Mr. W. H. Patton, of Montreal. Mr. Patton is a graduate of McGill University, and has been employed under Mr. Hodgson.

Mr. Letheule, an electrical engineer of Paris, France, paid a visit to Canada recently. He was commissioned by the French government to visit this country for the purpose of reporting as to the application of electricity for industrial purposes. He is said to have been highly pleased with the result of his research, and it is probable that his report will induce French capitalists to look to Canada as a favorable field for investment. Mr. Lethuele will probably return to Canada in the near future, on a more extended visit.

A well-known member of the Canadian Association of Stationary Engineers passed away at Stratford, Ont., recently, in the person of Mr. John Hoy. Mr. Hoy had been ill for a number of years. He was born in South Easthope 44 years ago, and had lived in Stratford the greater part of his life, having been an engineer in the woolen mills for about 15 years. He took an active interest in benevolent societies and in the welfare of the city, being a member of the separate school board. Engineers in general will learn of his demise with sincere regret.

SPARKS.

Mr. C. J. Smith, of Cleveland, Ohio, is superintending the work of replacing the old street lamps in London, Ont., by Adams-Bagnall Lamps.

There is a movement on foot in Victoria, B. C., for the compulsory inspection of stationery boilers. The matter has been taken up by the city council.

Mr. Thos. Marshall, engineer, Orillia, Ont., in remitting his subscription to the Electrical News, writes : "I find it one of the best engineering and electrical journals I have ever read."

It is probable that Mr. Warsap, manager of the cement works on False Creek, B.C., recently secured by a New York syndicate, will recommend that electrical machinery be installed for operating the works.

The building of a steamer at Westport, Ont., is said to have been decided upon by Captain Noonan, of Ottawa. The new craft will be fitted with an electric light plant, and will have a 12 x 12 compound engine.

The pioneer electric plant of the Boundary Creek district, in British Columbia, has been installed. It consists of an Edison dynamo and a Lively engine, furnishing 50 16 c. p. lights, and has been put in by the Mother Lode Mine in Deadwood camp.

The Guelph Light and Power Company recently added a new 1,000 horse-power incandescent dynamo, purchased from the Canadian General Electric Co. The necessary pulleys and castings were furnished by the Goldie & McCulloch Co., of Galt, Ontario.

A number of gentlemen purpose installing a new telephone system in the counties of Inverness and Victoria, in Nova Scotia. The proposal is to connect Northeast Margaree, Middle River, Big Baddeck, Baddeck, Nyanza, and Whycocomagh with Orangedale, on the Cape Breton railway. Professor Bell, of Baddeck, is interested in the company.

TRADE NOTES.

E. Leonard & Sons, of London, Ont., have supplied a new boiler for the pumping station at Fredericton, N. B.

The large elevator of the J. C. King Company, of Port Arthur, Ont., is being lighted throughout by electricity, the entire plant being furnished by the Royal Electric Company, of Montreal.

The Royal Electric Company are furnishing an electric light plant for the C. P. Railway elevator at St. John, N.B., and for this purpose have ordered one of the Dake patent engines from the Jenckes Machine Company, Sherbrooke, Que.

The plant for the town of Norwood, Ont., recently installed by the W. A. Johnson Electric Company, is said to be giving much satisfaction. The machine is one of their single phase inductor alternators, which are claimed to be practically indestructible, and have the advantage of a very low speed.

Mr. E. A. Walberg, of Montreal, has secured the contract for heating the Canada Atlantic shops at Ottawa, Ont., by the Buffalo Forge Company's system of fans. Kingsley Water tube boilers will be employed. It is said that the Canada Atlantic Railway Co. have under consideration a proposal to operate their shops by electricity.

The Packard Electric Co., of St. Catharines, Ont., have sent to their friends a daily note book for the month of January, on the front page of which is extended New Year greetings. Accompanying this booklet is an attractive circular making the important announcement that the Packard Company have arranged with the makers of the "Diamond c.p." supplies to handle these goods exclusively in the future.

In connection with the consolidation of the Westinghouse Manufacturing Company, of Pittsburgh, and the Walker Company, of Cleveland, we are advised that the Canadian representatives of the latter company, the W. A. Johnson Electric Company, of Toronto, will continue to represent the combined interests of the aforesaid companies in Western Canada. The advantage of this arrangement is evident, as the Westinghouse Company manufacture a most complete line of apparatus for long distance power transmission, including the A.C.D.C. generators, rotary transformers, induction and revolving field generators, etc.

WHAT AN ADVERTISEMENT SHOULD BE.

Mr. Frank A. Munsey, in an address before the Sphinx Club of New York on "Advertising in Some of its Phases," says: There are just two things to be kept in mind in the preparation of an advertisement—first, something to fix the reader's attention upon your particular advertisement, and second, the talk to the reader. What you say, your argument, your talk to the reader, should be attractively set, plain, neat, simple, short sentences and short paragraphs, and large clear type, well leaded. Cramped space does not give scope for well-set advertisements containing any considerable argument. Fine type closely packed together is unattractive, forbidding, and suggestive of hard work. The reader does not want hard work; he wants good easy reading—reading so easy, so attractive, so alluring, that he slides down a page without having intended to read it at all; but once having read it, it matters not what his intention was, the advertiser has got in his deadly work. He has begun to make himself known to that particular reader, has laid the foundation for future intercourse.

Mr. G. Whitaker, of Toronto, has been appointed assistant superintendent of the street railway at London, Ont.

Mr. Chas. E. Schooley has been appointed agent at St. Thomas, Ont., for the London Electrical Construction Company.

The Greenwood Water Power Company, of Greenwood, B.C., has been sustained in its right to the power at Boundary. The Greenwood Company had already expended about $4,000 in constructing a large dam above the falls, when the Cascade Water and Light Company asked for permission to use the power. The commissioner refused to grant the request.

Mr. I. H. Breck, electrician, of Kingston, Ont., has been exhibiting in a store window a small motor and dynamo, with complete electrical attachments. The dynamo is of his own make and contains four feeds, with 16,000 feet of wire in each, and 720 feet of wire in the armature. It will supply four standard lamps or their equivalent, and provides an alternating or direct current. The motor is of two horse power.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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NEW SERIES, VOL. IX.—No. 2.

FEBRUARY, 1899

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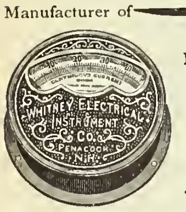

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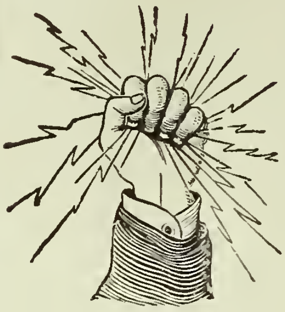

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Sherbrooke Gas & Water Co., Sherbrooke, Que.	2-40 in.,	" "
Lake Weedon Electric Light Co., Lake Weedon, Que.	1-15 in.,	" "
Stanbridge, East, Que., Stanbridge, Que.,	1-25 in.,	Vertical Setting.
Town of Granby, Que.	2-30 in.,	Horizontal Setting.
Mattawa Electric Light Co., Mattawa, Ont.	2-35 in.,	" "

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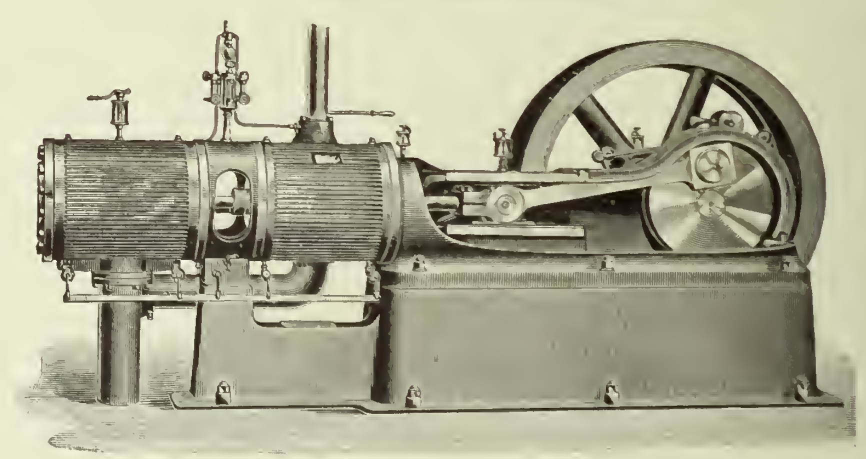

In the TANDEM COMPOUND the High Pressure Cylinder is placed next the frame, and both Pistons and Cylinder Heads may be withdrawn through the Low Pressure Cylinder without disturbing it. Both Valves are controlled by the Governor, so arranged that an equal amount of work is done in each Cylinder.

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CANADIAN
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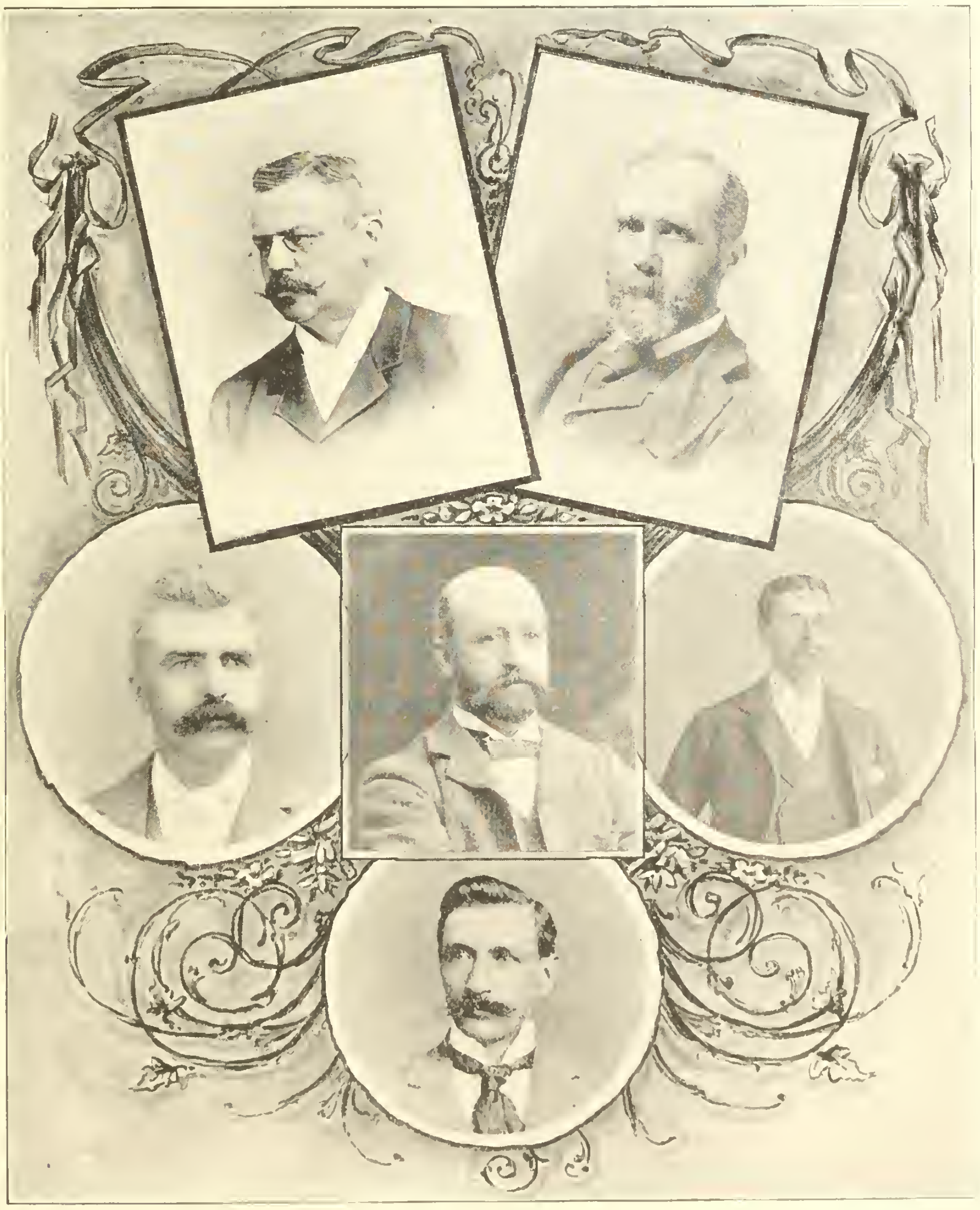
STEAM ENGINEERING JOURNAL.

VOL. IX. FEBRUARY, 1899 NO. 2.

OFFICERS OF THE MONTREAL STREET RAILWAY COMPANY.

It is with much pleasure that we present to our readers the accompanying group of portraits of the officers of the Montreal Street Railway Company.



HON. L. J. FORGET. MR. JAS. ROSS, C.E.
MR. D. A. L. MCDONALD. MR. F. L. WANKLYN, C.E. MR. W. G. ROSS.
MR. MARTIN H. WATTS.

OFFICERS OF THE MONTREAL STREET RAILWAY COMPANY.

Hon. L. J. Forget, the president of the company, is a native of Terrebonne, and a Senator for the division of Sorel. In addition to occupying the presidency of the Montreal Street Railway Company, Mr. Forget is president of the Richelieu and Ontario Navigation Company, a director of the Royal Victoria Insurance Company and of the Montreal Trust and Deposit Company, and vice-president of the Board of Governors of Laval University, Montreal.

Mr. F. L. Wanklyn, C. E., the manager and chief engineer, was born in Buenos Ayres in 1859, and educated in England. In Canada one of his first appointments was as assistant mechanical superintendent of the

Grand Trunk Railway, and later manager and master mechanic at the Point St. Charles locomotive works. Besides discharging the duties of these positions, he acted as consulting mechanical engineer to the Montreal Street Railway during the construction of the power house. He was appointed general manager of the Toronto Street Railway Company in January, 1897, resigning in the fall of the same year to assume the position he now fills. He is a member of the Canadian Society of Civil Engineers and an associate member of the Institute of Civil Engineers, England.

Mr. James Ross, C.E., vice-president and managing director, was born in Scotland, coming to Canada in the seventies. Since then he has been identified with the construction and management of various well-known steam railroads, his most notable work in that direction being the construction of the line of the Canadian Pacific Railway across a considerable portion of the prairies and through the Rocky mountains and the Selkirks into British Columbia. Since 1892 Mr. Ross has directed his attention and energies chiefly to street railways, and the cities of Montreal, Toronto, Winnipeg and St. John owe the successful construction and operation of their street railway systems largely to Mr. Ross' directive ability. In 1896, in conjunction with Mr. William McKenzie, of Toronto, Mr. Ross acquired the tramways systems of Birmingham, England, with the object of converting the system to electricity, and in 1897, in conjunction with the same gentleman and others, secured a charter and franchise from the Government of Jamaica to build electric tramways on the island. Mr. Ross is vice-president of the Toronto Railway Company, president of the Winnipeg Electric Railway Company, and of the St. John Railway Company, and president of the Dominion Bridge Company.

The comptroller of the company, Mr. W. G. Ross, was born in Montreal in 1863, and was appointed to the position in 1896. Previous to this he was engaged in the reorganization of the accounting departments of the Montreal, Toronto, Winnipeg and St. John Street Railways, which all have a uniform system of accounts. Mr. Ross is a prominent member of the Street Railway Accountants' Association of America, and one of the organizers of the same.

Mr. Martin H. Watts, the secretary of the company, is a native of London, Eng., where he was born in 1861. He came to Canada toward the end of 1886, and in December of that year entered the service of the Canadian Pacific Railway, where he was employed for four years in the law department of the company. In April, 1893, he secured the appointment of private secretary to Mr. Henry A. Everett, the well-known street railway promoter of Cleveland, Ohio, and at that time vice-president and managing director of the Montreal Street Railway Company. He filled this position, and subsequently that of secretary to Mr. Granville C. Cuningham, late manager and chief engineer of the company, until June, 1896, when, upon the death of Mr. Edward Lusher, Mr. Watts was appointed secretary.

Mr. Duncan A. L. McDonald, the superintendent of the Montreal Street Railway Company, was born at St. Thomas, Que., in June, 1859, and removed to Montreal in 1875. He entered the service of the Montreal Street Railway in 1881 as a "knight of the whip," in order to acquire a thorough knowledge of street railway work from its very commencement. He was soon advanced to conductor, and after about twelve months' service in that capacity, was promoted to the position of roadmaster. In 1886 he severed his connection with the company, but anticipating the progress that the trolley system would make, he went to St. Paul and Minneapolis in 1889 and secured a practical knowledge of the operation of electric tramways. He returned to Montreal in 1892 and re-entered the service of the Montreal Street Railway in the capacity of inspector. He was appointed to the position he now occupies in 1894.

QUESTIONS AND ANSWERS.

"J. M.," Toronto, writes as follows regarding the Arthur transmission plant: "Your article in January number, regarding above, for which I have to thank you, has been carefully read. On figuring out the line on the basis of the figures which you give, namely, that it delivers to the primaries of the step down transformers, over 13 miles of No. 4 wire, 9 amperes at 2,080 volts, I find that the loss in line only is 15½%. To get the total transmission loss, you must add to the above the losses in the transformers and in the secondary wiring, which will bring the total to something over 19%, instead of its being less than 5%, which your November article states it to be. If I am mistaken in above, I should be glad to be corrected. If my figures are correct, the publication in your February issue of an article correcting the November article will be much appreciated."

ANSWER.—In answer to the above, we believe the calculations given are correct, but the article in the November issue did not state the number of amperes transmitted at that time, which, for our correspondent's satisfaction, we may state was only five amperes, and at the pressure then in use, the ohmic loss was less than five per cent. In our reply in January, we perhaps should have noted that the loss was more than five per cent., owing to the transmission of nine amperes of current instead of five, for which the line was originally laid out. The business in Arthur has grown to such an extent that the owner of the plant has found it necessary to purchase a 1,500 light machine, and to operate at 4,000 instead of 2,000 volts, which will leave the losses, owing to the increased voltage, very small again.

"H.W." asks: (1) Will common iron wire serve as lightning arrestors when strung on electric poles from top to bottom, with the lower end connected with water? Will lightning jump from the electric wire to the ground wire or iron wire when placed an inch or two apart? (2) Is there any probability of acetylene gas or lime-light taking the place of electric light? (3) Is the system of using 220 to 240 volt lamps likely to come into general use? Do the underwriters accept these lamps?

ANSWER. (1) If ordinary fence wire is placed as described, with a few inches projecting above the top of the pole, and the lower end buried, it will be of great assistance as a lightning guard to the machinery, especially if lower end reaches water. Such wires should be placed quite frequently, say every fifth pole. Do not, however, take out the station arrestors. An inch gap is a rather long distance for the lightning to strike across, especially if there be any "grounds" on the system. (2) It is not wise to prophesy, but in the writers' opinion acetylene or lime-light will never displace electricity. Advantages claimed for acetylene

over electricity are brighter light for less money. At the present, the best incandescent lamp is not very efficient, using only about five per cent. of the energy it dissipates. Scientists are experimenting all the time, with a great probability that in the near future incandescent lamps will have an efficiency of double what they have now. That means either same light for half the money, or double the light for the same cost. Anyone who prefers the rather ghastly light of acetylene to the clear, cheerful glow of electric lamps is entitled to his preference, but he must take the risk of unpleasant smells, and quite possible explosions. (3) Underwriters accept 220 and 240 volt lamps in Europe and the United States when special precautions against leaks, etc., are taken. The only reason why such voltage is not more generally used is that the lamps are rather less efficient than those of lower voltage ; and there seems to be some little doubt of the manufacturers being able to produce a really good and durable lamp. No doubt, however, both these points will before long be satisfactorily settled.

"INDUCTION" writes : (1) What would be the resistance and line loss on a two-phase system carrying a load of 40 amperes (17 amperes and 23 amperes on each phase) at a pressure of 2,000 volts? The station voltmeter connected to a transformer of 20 to 1 ratio requires to register 118 volts to overcome loss, resistance and induction. The distance from power house to center of distribution is 25,300 feet, and the wires used are No. 3 B. & S. (2) How can I color incandescent lamps for decorative purposes that they may be cleaned at any time? (3) What does each division on an S.K.C. static ground detector denote when connected to a 2,000 volt primary?

ANSWER.—(1) The resistance of 25,300 feet of No. 3 circuit under the described conditions with 23 amperes is 97.3 ohms. As, however, the circuit contains joints, etc., it will be somewhat higher. The loss on such a circuit carrying 23 amperes (for copper resistance) will be 238 volts. The "inductive" drop will somewhat increase this loss, but unless some other data are given, such as distance apart of wires, it is not possible to accurately calculate it. The dynamo voltage, to overcome the above resistance, and leave 104 volts at the lamps, should be 2,318 volts—the indication on a 20-1 volt meter should be 116. No doubt the other two volts are required for joints, etc. (2) A very weak solution of shellac with the color added can be cleaned off by alcohol. (3) This information can best be furnished by the Royal Electric Company.

ELECTRIC LIGHT INSPECTION IN CANADA.

The report of the Commissioner of Inland Revenue for the Dominion, for the year ending June 30th, 1898, gives particulars regarding the inspection of electric light. The total revenue derived therefrom was $9,472, made up as follows : Fees for inspection, $5,388.25 ; registration of companies, $3,970 ; penalties, $114. The expenses of inspection were $3,236, and there were expended on standard instruments, $3,768.80, leaving a net revenue of $2,467.35. There were inspected during the year 3,754 meters. Of these 3,496 were found correct, 141 fast, 48 slow, and 10 unsound. A number were accepted after first rejection.

PERSONAL.

Mr. S. W. Jenckes, of the Jenckes Machine Company, has been elected a member of the town council of Sherbrooke, Que.

Mr. W. P. Cooke, of Port Arthur, was, at the municipal elections in January, elected as Railway and Light Commissioner for the town. He was also chosen as a councillor.

Mr. John C. Gardner, formerly secretary and manager of the Canadian Manufacturer Publishing Co., Limited, has been appointed president and managing director of the Might Directory Co., of Toronto, Limited, vice Mr. J. M. Might, retired. No doubt the energy and success which marked Mr. Gardner's career in his former capacity will be brought to bear upon the duties of his new position.

Many Canadian friends of Mr. F. C. Armstrong, who in May last accepted a responsible position in connection with the electrical department of Dick, Kerr & Company, of London, England, were pleased to have the opportunity within the past month of again meeting him. The purpose of his visit, however, was matrimonial in character. On January 12th he took as a life partner one of Cobourg's society favorites, in the person of Miss Helen McCallum. Before their departure for England, Mr. and Mrs. Armstrong visited some of the principal cities in the United States.

MOONLIGHT SCHEDULE FOR FEBRUARY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 5.50	A.M. 12.20	6.30
2....	" 5.50	" 1.00	7.10
3....	" 5.50	" 1.30	7.40
4....	" 5.50	" 2.40	8.50
5....	" 5.50	" 3.40	9.50
6....	" 5.50	" 4.50	11.00
7....	" 5.50	" 5.50	12.00
8....	" 5.50	" 6.00	12.10
9....	" 5.50	" 6.00	12.10
10....	" 6.00	" 6.00	12.00
11....	" 6.00	" 6.00	12.00
12....	" 6.30	" 6.00	11.30
13....	" 7.30	" 6.00	10.30
14....	" 9.00	" 6.00	9.00
15....	" 10.30	" 6.00	7.30
16....	" 11.10	" 5.50	6.40
17....	"	" 5.50	5.40
18....	A.M. 12.10	"	
19....	" 1.10	" 5.50	4.40
20....	" 2.00	" 5.50	3.50
21....	" 2.40	" 5.50	3.10
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	P.M. 6.20	P.M. 9.00	2.40
27....	" 6.20	" 9.20	3.00
28....	" 6.20	" 10.20	4.00
......	....	....	.....
......	....	....	.....
......	....	....	.....
		Total.........	183.30

Mr. J. R. Rayden, master mechanic at the Trail smelter, was killed by a shock received while repairing the switchboard in connection with the electric plant.

The town of Goderich, Ont., will seek authority from the provincial legislature to raise $5,000 for the purpose of improving he electric light and waterworks plants.

The Laurention Water and Power Company, of Lachute, Que., have requested extensive powers from the provincial legislature. The company propose to operate in the northern counties of Quebec, supplying electric light, gas, heat, power, etc., and constructing telephone lines. Mayor Prefontaine, of Montreal, and Mr. Pierre Laforest, of Joliette, are interested in the company.

The Canadian Marine Engineers' Association, Toronto, have elected officers for the ensuing year as follows : Hon. president, O. P. St. John ; president, Harry Parker ; first vice-president, A. J. Woodward ; second vice-president, D. F. Campbell ; secretary, S. A. Mills ; treasurer, H. Brownley ; inside guard, H. Bowler ; auditors, D. L. Foley, E. J. O'Dell, Owen Sound ; council, Thos. Good, Wm. Harwood, Rees Bench, Toronto ; P. J. Carr, Port Dalhousie, and J. E. Kane, Kingston.

CANADIAN ASSOCIATION OF STATIONERY ENGINEERS.

NOTE.—Secretaries of Associations are requested to forward matter for publication in this Department not later than the 6th of each month.

VALVE-SETTING.*

By W. Sweet.

The paper which I present to-night is upon valve-setting of steam engines, which is known to engineers throughout the world as a most essential feature. My paper is divided into three parts, namely, dead centre, valve-setting, and the relative position of the valve to the piston at all points of the stroke. I make this division for the purpose of treating each one separately. First I will take up dead centre. Nearly every engineer has a way of his own for finding the dead centre of an engine. The method which I have adopted is no doubt familiar to the most of you. The first thing to be done is to take a piece of wire and sharpen one end, and bend the wire almost in the shape of a figure 3; slip this piece of wire over the guide bar, so that it is comparatively firm, and let the sharp point project as close to the crosshead as possible. Then place the crosshead about one inch from the end of the stroke; now make a mark with a scriber on the crosshead, and move the wire so that the point is directly opposite the mark. Next take another piece of wire and sharpen both ends of it; then bend one end so that it projects at angles. Go to the fly-wheel or disc, make a mark on the floor, let the long end of the wire rest in the mark on the floor, and the projecting point come in contact with the wheel, and scribe a mark with it. Now turn the engine on the centre so that the mark on the crosshead comes directly opposite the point of the wire, go back to the fly-wheel again, and scribe another mark with the trammel in the same position as before. If this is done correctly, the centre between these two marks (which can be correctly obtained by the use of the compass) brought to the point of the trammel will be the dead centre of the engine.

Now we proceed to set the valve. This is a point which should receive very careful attention. Make sure that the valve has the correct travel; after this has been ascertained, proceed to give the valve the proper amount of lead, which depends upon the speed of the engine. The greater the speed the more lead is required. I might state that there are three kinds of leads; proper lead, improper lead, and permanent lead. I might also state that permanent lead can only exist in four-valve engines, but is most likely to be given to the valve of Brown engines, as these engines have their valve spindles screwed into the dash pot pistons; and engineers that are not thoroughly practical men, and not knowing what the results would be, are very apt to screw the dash pot piston down instead of moving the eccentric or cam ahead on the cam shaft. By screwing the piston down on the spindle to get the proper lead will give permanent lead. The position that the valve occupies to the piston may be determined in various ways, but the most accurate way, in my opinion, is to remove the steam chest cover, then place a piece of paper between the valve and face of the ports, attach a string to a reducing motion attached to the cross-head, the same as would be used for an indicator, pass the string around the pulleys, and bring it down past the centre of the steam chest; to the string attach a lead pencil, then by turning the engine over by hand and holding the pencil so that it will move up and down by the motion of the string from the crosshead, and using the face or the edge of the valve as a guide, an oval will be traced on the paper by the pencil, and by laying off the ports on the oval on the opposite side, according to the travel of the pencil, using a scale of one, two, or three inches of the crosshead travels to one of the pencil, this will give the position that the valve is to the piston at any part of the stroke.

Mr John Philip, of Grand Valley, is supplying the town of Grand Valley and the town of Arthur, which is thirteen miles distant, with incandescent light from his incandescent lighting plant in Grand Valley. He has met with such success with his transmission plant that he has purchased from The Royal Electric Company a 75 k.w. S.K.C. two-phase alternator, which he is installing in his power station. This will enable him to deliver at least 1,000 lights wired up in Arthur, and also to serve everything in sight in Grand Valley. As heretofore noted, this is a new departure in electric lighting, and we are glad to hear of Mr. Philip's success. It shows what pluck and enterprise will do.

* Paper read before Hamilton No. 2 C. A. S. E.

CANADIAN ELECTRICAL STUDENTS' COMPETITION.

The publishers of the Canadian Electrical News hereby offer a first and second prize of $15 and $10 respectively for the best thesis submitted by an undergraduate of a Canadian university on any one of the following snbjects, viz.:—

1. "The Magnetic Circuit of Dynamos."
2. "The Incandescent Electric Lamp."
3. "The Electric Meter."
4. "The Relative Advantages of Low and High Frequency in an Alternating Electric Lighting Plant."
5. "A Concise Description of a Method of Testing Transformers for Efficiency at Various Loads, both as Regards Regulation and Core Loss."
6. "Comparison between Two and Three Phase Installations for the Long Distance Transmission of Power."

It is required that each thesis submitted in this competition shall consist of not less than 5,000 nor more than 6,000 words, and shall be written in the third person, and typewritten for publication on one side only of foolscap paper.

To admit of a fair comparison of the merits of the theses which may be submitted, keeping in view variety of subjects, a system of marks will be employed such as is generally used in college examinations, and with which the competitors in this competition are familiar. These marks will be allotted under three heads, viz.:—

1. Subject Matter.
2. Arrangement.
3. English.

Taking 100 as the combined total, the maximum and minimum marks for each of the above classifications will be as follows:

Maximum.		Minimum.
50	Subject Matter	25
25	Arrangement	15
25	English	15

If any of the theses submiited should not be entitled to receive the minimum of marks as above, they will be entirely rejected.

There are three sources from which competitors must draw their subject matter, viz., books, periodicals and floating literature, personal or private channels. In judging of the subject matter, the following relative values will be attached to the above mentioned sources of information:

(a) Books	10
(b) Periodicals and floating literature	20
(c) Personal or private sources	20
	50

Where extracts are used, their source and names of authors should be clearly given.

Where diagrams are required to illustrate the text, they should be drawn with pen and perfectly black ink on pure white drawing paper, bristol board or tracing linen, and in such manner as to admit of their reproduction to a small scale.

Each thesis shall be submitted by motto only, and shall be accompanied by the name of the author enclosed in a sealed envelope bearing the same motto. This envelope will remain sealed in the hands of the publishers until the competition shall have been decided.

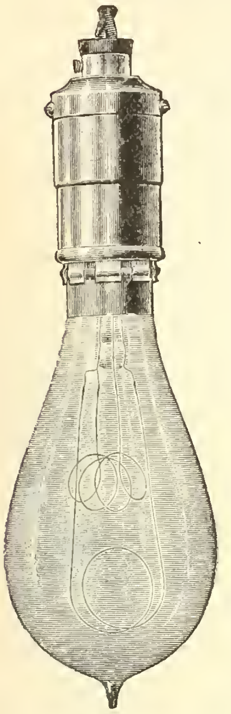
Theses submitted in this competition must reach the C. H. Mortimer Publishing Company of Toronto, Limited, Toronto, Ont., publishers of the Electrical News, before the first day of October, 1899.

A competent judge has been chosen to decide the competition in accordance with the method explained above. This gentleman, whose name will be given at a later date, will no doubt be acceptable to all concerned.

The result will be published as soon as possible after the close of the competition.

The publishers of the Electrical News reserve the right to publish such of the theses submitted as in their judgment may appear to be desirable for that purpose.

NEW REGULATING LAMP.



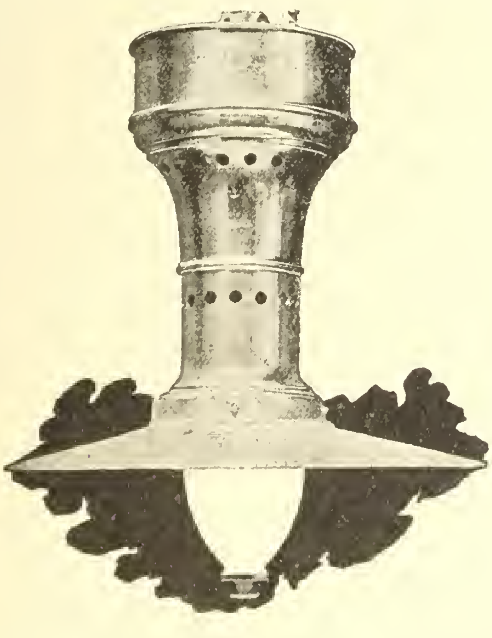
The Truitt regulating lamp which has just been placed on the market in Canada appears to be likely to fill a need which exists among electric light consumers, viz., that of being able to regulate the light of each individual lamp without having to pay for more current than is being used.

It is claimed for this lamp and socket, of which we give an illustration herewith, that it contains no coils whatever, consequently being vastly superior to the old style of regulating sockets, the coils of which were liable to become damaged or burnt out, and also wasting considerable current unnecessarily.

By using two separate filaments a slight turn of the lamp in its socket gives, first, a one candle power light suitable for a sick room or as a night light; the next light is eight candle power, then 16, and then 24, this being arranged by the different contacts in the socket connecting either of the two filaments separately or in series or multiple. A special socket is required so as to enable the lamp to be turned either way. No key or switch is used, as a further turn of the lamp cuts off the current entirely. We understand that Messrs Ness, McLaren & Bate, of Montreal, control the sole agency for Canada.

A NEW COMPETITOR FOR THE INCANDESCENT GAS LAMP.

We take pleasure in illustrating below a new competitor for the incandescent gas lamp, in the form of an enclosed arc lamp made in very miniature dimensions, and of an exceedingly neat and original design. This "Tiny Lamp," which is rapidly replacing cluster incandescent lamps, is only thirteen inches in length, and consumes only 275 watts per hour, giving about eight hundred candle power, and using considerably less



current than the average cluster incandescent lamps, and less than one-half of the amount used by the regular standard enclosed arc lamps made by the same company.

The station managers in many places are using these lamps in show windows and for store lighting at the regular prices flat rate per month for the standard five-ampere enclosed arc lamps and are claimed to be making a very material saving in operating expenses, while the customer is getting the same amount of light as he would from the large lamp with the double alabaster globes so commonly used. The customer is even better pleased if the central station is willing to reduce his current bill a trifle, and will hasten to explain the advantages of the new light to his friends, with the outcome of much good to all parties concerned. The "Tiny Lihtan Lamps" are made in a variety of styles, and are sold at reasonable prices. At the present time the factory, which is crowded with work, is being extended, and in a short time will have double its present capacity.

In their Tiny Lihtan lamp the manufacturers claim the easiest lamp to trim ever introduced, and a person once using them can readily appreciate the difference between the old and cumbersome methods of getting out the inclosing globes and replacing the new carbons in proper alignment. There is a very effectual automatic "cut-out" in the lamp, which prevents its being injured by letting the lower carbon burn down too far and breaking the inner globe. This is entirely new and original.

These lamps are being turned out in large quantities by the Safford Arc Lamp Manufacturing Co., of Buffalo, N.Y., and immediate shipments can be made. Circulars give prices and further particulars.

ELECRICAL TRANSMISSION PLANT FOR ORILLIA.

By a vote of 399 to 61, the property-holders of Orillia, Ont., on the 6th inst., decided in favor of installing the first long distance electrical power transmission plant in America, if not in the world, which will be owned and operated by a municipality. This plant, the construction of which will be begun immediately, will cost not less than $75,000, and is intended to convey the current generated at the Ragged Rapids, on the Severn river, to the town, a distance of over 19 miles. Eight hundred horse power will be delivered as a first instalment, but the system will have a capacity for delivering 1,000 horse power, and can ultimately be increased to a capacity for 3,000 horse power at comparatively small additional expense.

The hydraulic power was investigated by Mr. Wm. Kennedy, jr., of Montreal, who prepared general plans to govern reception of tenders, and the electrical plant and transmission line were designed by Mr. Roderick J. Parke, consulting electrical engineer, of Toronto, who also prepared the necessary plans and specifications for reception of tenders for these sections.

The contract for the entire equipment has been awarded to the Central Construction Co., of Buffalo, N.Y., at $67,200. The electrical machinery will be furnished through the W. A. Johnson Electric Company, of Toronto, the plant to consist of two 400 h.p. revolving field Westinghouse three-phase 60 cycle generators, each having an overload capacity of 60 per cent., provided with the necessary high tension switchboards and controlling apparatus. Six step-up 100 k.w. static transformers, self-cooling type, will raise the voltage to 22,000 for the transmission line. At the receiving station at Orillia there will be six step-down 100 k.w. transformers, of a similar type, to reduce the pressure to 1,000 or 2,000 volts, so that the alternating incandescent circuits now used for commercial lighting can be connected direct to the above transformers. There will also be provided a 25 h.p. Tesla induction motor, for driving the waterworks pump, now operated by steam, and a 50 h.p. motor of same type to drive the three Ball 25 light arc dynamos, which have been used for street lighting for some years. The switchboard apparatus, lightning arresters, etc., have been carefully selected and so arranged that uniform service and safety in handling can be relied upon, notwithstanding the high voltage.

The Stillwell-Bierce & Smith-Vaile Co., of Dayton, Ohio., are sub-contractors for the water wheels.

The plant will be installed under the supervision of Mr. Parke, who will have associated with him Mr. Chas. H. Mitchell, hydraulic engineer, of Niagara Falls, who will supervise the construction of the hydraulic plant at the rapids. The work will be pushed to completion with least possible delay, and it is expected to have the system in operation before the end of October next.

TELEGRAPH and TELEPHONE

NEW C. P. R. TELEGRAPH OFFICES.

THE business of the C. P. R. in Winnipeg having outgrown its office accommodation, steps were taken last fall to provide new quarters. The building at the corner of McDermott and Main streets was secured, and remodelled for the purposes of ticket and telegraph offices. A few weeks ago possession was taken by the staff. The installation of the plant, which is one of the most modern and up-to-date on the continent, was superintended by Mr. W. J. Camp, chief electrician of the company. On the ground floor is the city ticket office, the telegraph office, the private offices of the city manager, Mr. John Tait, and the general delivery office and messenger boys' head-quarters. On the second flat is the office of Mr. B. S. Jenkins and his assistants, while the fourth floor contains the large operating room, battery room, and other neccessary apartments.

The battery room contains 200 cells of storage battery of the chloride accumulator type, arranged in seven banks of 43 cells, each giving a current of 90 volts. There are also six larger cells used for the purpose of working the sounding or reading instruments. These cells take up the place of 2,400 cells of chemical batteries as used in the old office, effecting not only an economy in space and a saving in cost of maintenance, but giving a much more satisfactory current. It is expected that these cells will last four or five years, requiring during that time scarcely any attention.

The operating room contains 36 sets of instruments. Some of these are what is known as quadruplex, originally invented by Thomas A. Edison, but greatly improved by F. W. Jones, electrical engineer of the Postal Telegraph Company, by means of which four men work on one wire—two sending and two receiving. Thus four different messages are flashing back and forth on the same small wire, with never a collision or sign of confusion.

In order that the operator may hear only his own instrument, it is placed in a small box raised to the level of his ear, a device that does away with the old system of glass partitions. One peculiar feature of the room is the entire absence of wires, these being conveyed to the tables in cables that run under the floor. Above the switch-board is a large number of incandescent lamps, whose peculiar function is to light up when anything goes wrong on any one of the lines. The interruption is thus located without the trouble that would otherwise be occasioned.

The outside wires enter by cables which terminate in a row of porcelain fuse blocks and earth plates. By means of these any abnormal current, such as would be caused by the contact of the telegraph wires with electric light or trolley wires, is arrested and the circuit broken. Lightning is another source of abnormal current which, without these precautions, would ruin the instrument.

The fifty-two operators employed by the company in Winnipeg have means of recreation provided for them in the building in the shape of a reading room and billiard and pool room.

SHORT-CIRCUITS.

Mr. J. P. Gardiner, who has had charge of the Bell Telephone exchange at Kingston, has been promoted to the management of the Stratford office.

Seventeen telegraph poles on the C. P. R. line near Stittsville, Ont., fell down recently, owing the weight of ice on the wires. Telegraphic communication was completely broken off for a time.

A company has been formed to construct a telephone system in the counties of Iverness and Victoria, N. S. The company will make Baddeck their headquarters, and anticipate little trouble in raising the neceesary capital to carry out the project.

Mr. Ruben Stiber, who had been employed in the head office of the C. P. R. for 12 years, died at his home in Toronto recently. He was a well-known musician, and at different times filled the position of organist in some of the largest churches in the city.

Mr. H. P. Dwight, president of the Great Northwestern Telegraph Company, states that the general increase in Canadian business has caused a marked improvement in the business of his company all over the country. People are busy, and in consequence are using the telegraph wires to a greater extent.

The Bell Telephone Company has now about one and one-quarter miles of underground wires in the city of Hamilton. It is said that in the spring steps will be taken to double the present underground system, to meet the requirements of the increasing business and to relieve the pressure on the poles.

The Union Telephone Company, Limited, of Taylorville, N. S., has been organized to construct a telephone line from Middle Musquodoboit to Taylorville. Mr. Edger Archibald is president and Mr. Sidney Lindsey secretary-treasurer.

The Victoria & Esquimalt Telephone Company are about to make some improvements in their system at Victoria, B. C. A new switch-board will be installed, and as soon as this is placed in position the puttting in of a metalic circuit will be commenced.

A settlement has been reached between the Grand Trunk Railway and their telegraph operators. The result is, we understand, satisfactory to all concerned. The minimun salary will be as follows: Agent and telegrapher with dwelling, light and fuel, main lines, $38; branch lines, $35. Agent and telegrapher, without dwelling, fuel and light, main lines, $43; branch lines, $40. Telegraphers, main lines, $38; branch lines, $35; relieving agents who are on the permanent staff and are telegraphers, main lines, $50, branch lines $50.

The prospectus was issued in England recently of the Canadian, British Columbian and Dawson City Telegraph Company, Limited, with a share capital of £300,000. The directors are:—Sir James Grant, Sir A. P. Caron, Ottawa; J. H. Turner, M.P.P., Victoria, B. C.; Alderman J. Hyde, Mayor of Banbury; W. P. J. Fawcus, M.I.C.E,, M.I.E.E., director Edison & Swan United Electric Light Company, London. The consulting engineer is Sir T. S. Tancred, Bart., C. E.; resident engineer, E. G. Woodford, C. E., late state mining engineer, Transvaal; secretary, W. Young, 64 Victoria Street, London.

SPARKS.

The village of Kamloops, B. C., will probably purchase another dynamo for the electric light plant.

At Whitby, Ont., there is said to be a feeling in favor of installing a municipal electric light plant.

The Ottawa Street Railway Company are said to be considering the extension of their road to the rifle ranges.

Harry Pope, of Peterborough, Ont., while engaged in wiring a building in Montreal, fell a distance of 15 feet, breaking both his arms.

At the Parliament buildings, Toronto, a competitive test was recently made of the steam producing qualities of coal and compressed peat.

The Montreal Island Belt line Company have contracted with an ice dealer for the transportation of 35,000 blocks from Bout de l'Ile to Moneau street.

Mr. W. Sills, an extensive mica dealer of Chicago, announces that he has made arrangements in European countries for the reception of a large quantity of Canadian mica. The mica will be shipped direct from the mines near Ottawa to the European markets, and it is hoped to be able to compete with the India supply, which, on account of the cheapness of labor, is sold at a low figure. The methods of mining and transportation in India are crude, the entire operation being performed by hand. For this reason the Canadian product, worked by modern methods, should have the advantage in price on the European market.

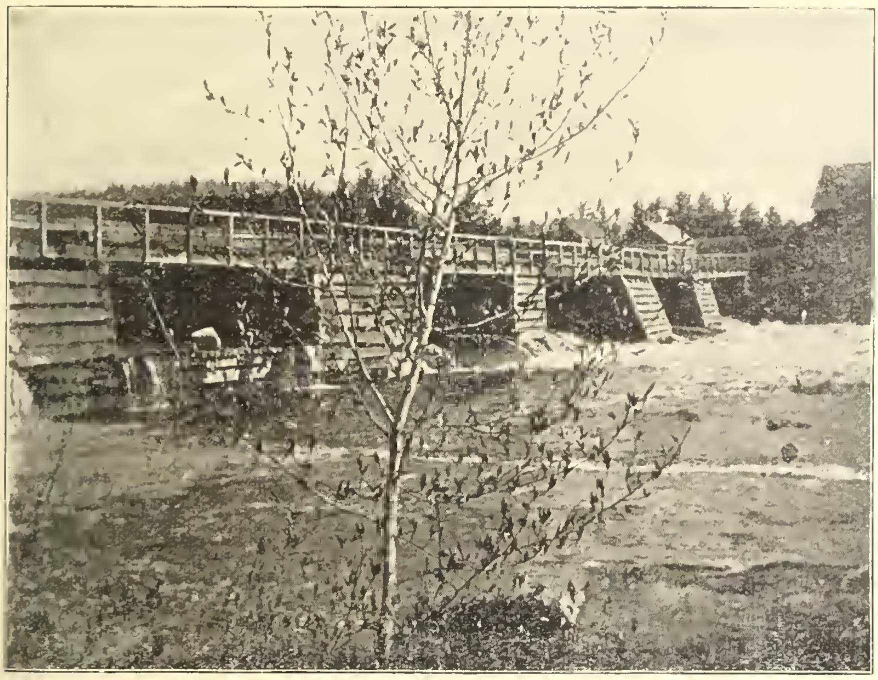
A neat automatic oiling device for the ordinary four-bar guides and crossheads of steam engines is made by drilling a hole through from side to side of the crosshead jaws through the middle of the wrist pin, tapping one side for an oil cup and the other for a plug. Then drill a hole in the top face of each jaw and one in the top of the wrist pin to intersect the long hole. If the pin is larger than the thickness of the jaws, plane a groove across the top of the hole to make the top of the three holes on the same level. The overflow will oil the top guides and pin. Another hole in each jaw clear through will conduct the oil to the bottom guides. A self-feedlng oil cup or a wiping device can be used according to choice, or soft grease may be used instead of oil by having the holes drilled, the jaws intersecting the long hole, and by having a spring greace cup.

Acting under authority from the goverement, Mr. Phillips recently made an inspection of the Port Arthur Electric Railway. He has made a lenghty report on the condition of the road. He finds that on some portions of the line within the limits of Fort William there is no planking inside or outside the rails, and that on other portions the planking is in very bad condition, that the rails in places are about street grade, and the earth filling below the level of the rails, and that the ends of the ties are exposed. At some street intersections there are no crossing planks. Frogs at turnouts are not packed as required by law. The trolley wire, No. 4 copper, is too small, and it appears from the number of splices that there has been considerable trouble with the wire breaking. At places the wire is too low, being only 12 to 14 ft. above the rails, on account of the span being slack, the poles on the sides of the streets leaning toward the roadways owing to the soft nature of the soil, or imperfect setting. There is no guard wire over the trolley wire to protect telephone and telegraph wires from contact with the trolley wire. A great number of the insulators used in attaching the trolley wire to the span wire are in bad condition, and must allow the spad wires to become charged with electricity in a number of places.

WATER POWERS OF ONTARIO.*

By Thomas W. Gibson.

If Mr. Tesla's conclusion be correct, namely, that a waterfall affords us the most advantageous means of getting power from the sun for all our wants, excelling for this purpose not only muscular force, but wind and steam as well, the rocky uplands of northern and western Ontario may yet be reckoned among the most valuable parts of the province by reason of the vast number of waterfalls situated there. The main watershed dividing the system of the great lakes from that of Hudson bay runs in a northwesterly direction from the eastern boundary of the province north of lake Temiscamingue to the head of lake St. Joseph, on the northern boundary, a distance of about 500 miles. It consists of a tableland or plateau rather than a sharply defined ridge, and is estimated to have an average width of about 70 miles, or an area of about 35,000 square miles, thus with the slopes on both sides affording an extensive catchment surface for the streams running to the north and south. Its elevation will average perhaps 1,400 or 1,500 feet above the level of the sea, or 900 feet above lakes Huron and Superior. In places it approaches the shore of the latter lake, and for the greater part of its extent is situated at a comparatively short distance from either of these bodies of water. The consequence is that the rivers and streams which flow from it into the great lakes, though mostly of considerable volume, are not of great length, and their descent is therefore usually rapid and abrupt, and marked in many places by cascades and falls.



Lower Dam and Bridge at Palmer's Rapids, on the Madawaska River.

The value of a river of given volume for purposes of water power does not altogether, or even chiefly, depend upon the amount of its fall from source to mouth. Of course, the greater the fall the greater the energy possessed by the stream as a whole. But it is apparent that if the descent be gradual and uniform, or approximately so, there will be few places in its course where the fall is large enough to afford any considerable quantity of power. It is only where sudden falls or rapids occur, which create a decided difference in the level of the water, that the energy of the river is concentraded, as it were, within a short space, and can be utilized. The nature of the soil or surface of the country through which the river runs has an important effect in influencing the habit of the stream in this respect, and so determining its value as a producer of power. If it be composed of sand, clay, gravel or even the softer or more easily decomposed rocks, it will usually be found that the river has worn its bed to a fairly uniform slope throughout, in which case there will be few opportunities of developing power from its waters. Even if a slight drop should occur, a dam would probably be required in order to obtain any considerable head, and the erection of dams, while often necessary and advantageous, involves additional expense both in construction and maintenance. In a river whose bed is composed of hard rock, such as is usually comprised in the Laurentian and Huronian formations of northern and western Ontario, the eroding force of the water meets with much greater resistance, and its course is more likely to be marked by abrupt changes of levels in rapids and falls, and indeed this is characteristic of many if not most of the rivers in those parts of the province. Another prominent feature of the topography of these districts is the very large number of lakes, varying in size from mere ponds to large and important sheets of water. These are either

Section of Lower Dam and Bridge at Palmer's Rapids.

* From the report of the Ontario Bureau of Mines.

the sources of or tributary to the rivers, or expansions of them, and act as reservoirs or storage basins, tending to regulate the flow of the water and to render it constant and steady throughout the year.

The character of the country in northern and western Ontario is therefore such as to provide an almost illimitable amount of water power readily available. Taking into account the annual precipitation of moisture in the form of rain and snow, there is no reason to doubt that hundreds and thousands of horse power could be generated from the waters of streams flowing into the great lakes with a minimum of trouble and expense. A shorter watershed running from the main one southwesterly round the western end of lake Superior divides the streams falling into that lake from those which find their way into lake Winnipeg and so into Hudson bay, and the waters running in both directions from this divide furnish many fine water privileges, similar in character and equally available ; while tributary to the Ottawa river, and in that part of the province included within the boundaries of Algonquin National Park, as well as to the south and west, are numerous rivers of considerable fall and volume, from which a very large additional amount of power could with little difficulty be obtained. The streams flowing into Hudson bay, such as the Albany, Kenogami, Missinaibi, Mattagami and Abitibi are of greater average length than those running into the great lakes, and as they descend to the level of the sea, say 600 feet below that of lakes Superior and Huron, many falls are to be found upon them, particularly in their upper reaches and in the neighborhood of the "long portages," where their waters are interrupted by the hard rocks of the old formations on their way to the more level Devonian plains bordering on James Bay. For the present, however, these rivers are too remote to be regarded as sources of available power, though the time may come when they will be called into requisition.

On the Seine, Atik-okan, Wabigoon, Winnipeg and Rainy rivers ; on the Mattawin, Kaministiquia, Nipigon, Steel, Pic, Magpie and Michipicoton ; on the Mississaga, Thessalon, Spanish, Vermilion, Wahnapitae and Sturgeon ; on the Montreal, Ottawa, Petawawa, Bonnechere and Madawaska ; on the Muskoka, Magnetawan and Severn ; and on many others, there are numerous falls and rapids waiting to be utilized and capable of doing the work now being done by all the steam engines in Ontario a hundred or a thousand times over. This is leaving out of view the waterfalls already developed and in use in the older portions of the province, as well as the stupendous energies of the falls of the St. Mary and Niagara rivers, which are already, one on the Canadian and the other on the American side, to some extent made use of.

PRACTICAL USES OF POWER.

The rivers enumerated above are situated among the forests of pine and hardwood which cover so considerable a portion of New Ontario, and in many cases they are contiguous to valuable deposits of ore or mineral. The raw material for many industries lies around them. The sawmill, planing mill, sash and door factory, pulp mill, match factory and many other wood-working industries might happily combine abundant raw material and cheap power on these streams, while stamp mills and other mining plants might be worked with profit and success. Other industries, such as woollen, cotton and flour mills and chemical manufactories, might avail themselves of the cheap power without necessarily locating in the immediate neighborhood of the waterfall, by connecting themselves with it by means of the electric current, though for textile, paper and other industries whose processes necessitate the use of large quantities of clear water, a waterfall convenient to means of transportation forms an ideal site. Electrically driven railways seem likely to come into vogue in this and other parts of the world because of their low first cost and inexpensive maintenance, and it appears feasible to operate electric roads by currents generated by the waterfalls on the rivers in many parts of the districts referred to. Such railways might serve a very useful purpose in carrying lumber, ore, raw and finished material and supplies of all kinds in a country where perhaps the volume of traffic might not be sufficient to render an ordinary steam railway a profitable undertaking.

Water power, whether employed directly to operate machinery, or converted into electric energy for the same purpose, has many advantages over the steam engine. For the same quantity of power, its first cost is not usually much greater, and often not so great, and once installed it requires little or no attention. Its danger to life and property is less. It needs no fuel, a consideration specially important in Ontario, which has no coal beds, and where in time even the present abundant supplies of wood will be exhausted. Hitherto the chief disadvantage of water power has been its immobility. If a waterfall was not conveniently situated, it was of little or no use. If it did not pay to place a manufactory alongside a waterfall, the fall could not be brought to the factory. Now this has to a large extent been changed, and power can be delivered without serious waste many miles from where it is electrically produced. The change will be still more marked when the problem of transmitting electric energy through long distances has been thoroughly solved, and Nikola Tesla looks forward to a speedy solution.

The presence of so many available water powers in the Lake of the Woods, Seine river, Wahnapitae and other mining districts of Ontario is a fortunate circumstance and cannot but have a very favorable effect upon their development. Cheap power means economy in working, and will permit of ore bodies being profitably utilized which would otherwise not pay for treatment. The immense deposits of low grade ore which are found north of lake Superior and on the Upper Seine are in many cases situated in proximity to waterfalls capable of yielding hundreds and thousands of horse power at comparatively little expense. The importance of preserving these water powers as far as possible for the general benefit and preventing their being locked up in the hands of speculative individuals who would not use them themselves, but who would demand heavy toll for their use by others, has led to the adoption of new regulations under the Act respecting Water Powers, (61 Vict., chap. 8) passed at the last session of the Legislature. The principal features of these regulations are those which provide for the leasing of such powers by the Crown, instead of patenting them outright, and for the furnishing of surplus power by the lessee to others on terms to be fixed in case of disagreement by the Lieutenant-Governor in Council.

The full text of the Act, which was assented to January 17, 1898, and of the regulations, which were

apopted by order-in-council dated June 21, 1898, is as follows :

AN ACT RESPECTING WATER POWERS.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows: The Commissioner of Crown Lands may reserve from sale any water power or privilege on the Crown Lands of the Province, and a sufficient area of land in connection therewith for the erection of buildings and plant, together with the right to lay out and use such roads as may be necessary for passage to and from such water power or privilege and land, and may under regulations be approved by the Lieutenant-Govenor in Council make terms and conditions upon which such water power and land so reserved may be sold or leased, and developed.

REGULATIONS RE WATER POWERS.

1. These rules and regulations shall not apply to water privileges which in their natural condition at the average low stage of water have not a greater capacity than 150 horse power.

2. In granting or leasing otherwise than under these regulations any Crown lands upon which a water privilege is situated, the said privilege shall be reserved to the Crown, together with such an area of land in connection therewith as shall in the opinion of the Commissioner of Crown Lands be required for the proper development of the same, and the construction of all necessary dams, weirs, tunnels, races, flumes, sluices, pits and other structures of works, and the erection of buildings and plant for the employment and utilization of such privilege, and storing grounds and yards in connection therewith; and there shall also be reserved in any such grant or lease the right to flood any such portion of the lands so granted or leased upon compensation to be made to the owner or lessee thereof by the person or persons to whom such privilege shall afterwards be leased ; and the said water privilege, land and right so reserved shall form a separate property to be dealt with as hereinafter provided.

3. The right to lay out and use such roads as may be necessary for the passage to and from such water privilege or land shall be reserved in all grants or leases of contiguous or adjoining lands.

4. The applicant for a water privilege situated on Crown lands shall, if necessary, file in the Department of Crown Lands a plan and field notes by an Ontario land surveyor of survey thereof; and also a statement setting out :

(a) The location of the water privilege applied for, and a description of the land required in connection therewith.

(b) The height of the fall or rapid, the volume of water at the average high and low stages of same, the estimated capacity in horse power of the fall or rapid in its natural condition at the average low stage of water, the height of the dams or weirs (if any) which it is proposed to construct, and the increase in the level of the water which such dams or weirs will bring about.

(c) The nature and location ot the business, plant or manufactory in connection with which it is proposed by the applicant to utilize the water privilege, and the number of horse power which the applicant proposes to develop and use (1) within two years, (2) within five years.

(d) The plan by which the applicant proposes to develop the water privilege, showing the dams, weirs, tunnels, races, flumes, sluices, pits and other structures of works which it is proposed to build or make in connection therewith, the estimated cost thereof, and the form in which the power is to be used or transmitted, that is, whether by direct energy, electricity, compressed air, etc.

(e) The land or lands which would be over-flowed or otherwise affected by the raising of the water or the construction of the dams, weirs, sluices, races or other works in connection with the development or use of such water privilege and the owner or owners thereof.

5. The Commissioner of Crown Lands shall have power to call for measurements, plans, specifications, descriptions, levels, profiles, elevations and all such other information as he may deem necessary for the proper consideration of the application, which shall he furnished at the applicant's expense. The plans and specifications for the construction of the necessary dams, weirs, tunnels, races, flumes, sluices, pits and other works for the development of such water privilege shall be submitted to the Commissioner of Crown Lands, if so required by him, and such works shall not be proceeded with until the Commissioner has approved the plans and specifications.

6. The applicant shall submit such proof of his financial standing and ability to develop the said water privilege as shall be satisfactory to the Commissioner of Crown Lands.

7. On approval by the Commissioner of Crown Lands of an application for a water privilege, he may order a lease of same to issue therefor, such lease to be for a term of ten years, with the right of renewal for a further term of ten years at the same rental, if the covenants and conditions have been performed and fulfilled, and thereafter with the further right of renewal for a term of twenty years upon such terms and conditions and at such rental as may then be provided by law or regulation.

8. The rental under any such lease shall be such sum as may be fixed by the Commissioner of Crown Lands, and shall be payable yearly in advance. Where application is made for the right to develop not more than half the maximum estimated capacity of a privilege at the average low stage of water as aforesaid, and where the granting of such application would not prevent or interfere with the development by other parties of the remaining capacity of the said privilege, the Commissioner may grant the same and may, if he thinks proper, reserve a portion of the land connected with the water privilege, provided that in any such case the Commissioner may issue a lease or leases for the remaining capacity of the said privilege, and the remaining lands connected therewith.

9. The right of timber owners and other to drive their logs down any river, stream or other body of water, as now by law established, shall not be interfered with, lessened or restricted by the granting of any such lease ; and if any dam, weir or other structure be erected or built in connection with the development of any such privilege, with the object, intention or effect of damming the water or impeding the flow thereof, full and proper provision as now by law required shall be made by the lessee for the passage of logs and timber over and through same.

10. The lessee under any such lease shall not destroy or obstruct the navigation of any river, stream or body of water previously navigable, but shall provide such locks, canals, passages and other means as may be necessary for the proper and safe surmounting or passing of any dam, weir or other work made or erected by the lessee.

11. The lease shall provide—

(a) For the development and use within a period to be named in the lease of at least one-half the power proposed to be developed and used, and for the development and use of the full capacity of the privilege estimated as aforesaid, or of the remainder of the power proposed to be developed and used as the case may be, within a further period to be named in the lease.

(b) For the use by other parties than the lessee of surplus or unused water or power not required by him for the purposes of his business, plant or manufactory on such terms as may be agreed upon; and failing an agreement between the parties as to the terms and conditions on which such surplus or unused water or power may be used, and the remuneration to be paid therefor, the Lieutenant-Govenor in Council shall have power to fix and determine the same, and any Order in Council fixing such terms, conditions and remuneration, shall be final and conclusive and binding upon all parties concerned.

(c) For the erection and maintenance by the lessee of a durable and efficient fishway when so required by the proper officer or authority in that behalf.

(d) Failure or refusal of the lessee to comply with the conditions of the lease, or default in payment of the yearly rental for ninety days after the same falls due, shall work a forfeiture of the lease.

(e) During a continuance of the lease, the lessee shall keep and maintain all dams, weirs, tunnels, races, flumes, sluices, pits and other structures and works necessary for the development and use of such privilege in good repair and condition, and shall not wilfully or otherwise injure or destroy the same or any part thereof, but at the expiry or sooner determination of the said lease, shall leave all such structures and works in good repair and condition, and so that their subsequent usefulness shall not be lessened by any act of the said lessee.

(f) At the expiry or sooner determination of the lease, the water privilege shall revert to and become the property of the Crown as fully as if no such lease had been granted, together with all dams, weirs, tunnels, races, flumes, sluices, pits and other structures or works made or erected by the lessee in connection therewith, and all buildings erected on land covered by the lease; but the lessee shall be allowed a reasonable time to be fixed by the Commissioner of Crown Lands in which to remove all machinery employed by him in the development and use of the privilege, failing which removal such machinery shall become the property of the Crown.

(g) Where there is more than one applicant for a water privilege the Commissioner of Crown Lands may, at his discretion, put the same up at public auction or tender, subject to the foregoing conditions, to be awarded to the highest bidder or tenderer for a lease thereunder.

(h) If at any time or times after the water privilege has been developed, either in whole or to the extent to which the lessee is bound by the lease to develop the same, the said lessee shall continuously neglect for the space of one year effectually to produce power from the said privilege, either for his own use or for that of other persons, unless hindered by unavoidable accident, the Lieutenant-Governor in Council may order and direct the said lease to be forfeited and cancelled.

12. Where a water privilege is applied for by a municipal corporation for the purpose of supplying water, power, light, or heat for the use of the inhabitants thereof, the Commissioner of Crown Lands may issue a lease of said privilege to such corporation if otherwise entitled to receive and hold the same, on such special terms and conditions and at such rental as he may deem proper.

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Mr. Tesla and His Critics.

FOR having been so bold as to call i question some of Mr. Nikola Tesla's recent statements before the Electro-Thereapeutic Society, the New York Electrical Engineer has called down upon its head a storm of personal abuse from the pen of the erstwhile brilliant experimenter and inventor. It is gratifying to observe that some of the leading electrical journals refuse to print the illogical and abusive epistles which Mr. Tesla is seeking to hurl at the heads of the editors who have offended him. The fact is that Mr. Tesla has of late talked a great amount of nonsense, which, nevertheless, owing to the position which he occupies, or has occupied, is calculated to temporarily unsettle the value of electrical investments. He has promised to do a great many things which he has failed to do, and in consequence has lost caste with the electrical fraternity. It was time that he should be "called down," and the Electrical Engineer is entitled to credit for having performed the disagreeable task in a gentlemanly manner.

Electric Railway Development in Toronto.

IMMEDIATELY following the approval by the citizens of Toronto of a by-law authorizing an expenditure of $150,000 for the building of a public market, comes the proposal of the Toronto Railway Company to construct a system of radial electric lines connecting the city of Toronto with all parts of the county of York. Whether viewed from the standpoint of the city resident or of the farmer living in the county, the carrying out of both these enterprises seems to be highly desirable. It is somewhat doubtful whether a modern market established on so large a scale as is proposed could be successful in the absence of a system of radial electric lines which would make tributary to it the products of one of the richest agricultural counties in Canada. On the other hand, the market is almost if not quite as important an adjunct to the success of the electric railway enterprise, as the necessary freight cannot be obtained unless an outlet be provided for its disposal in Toronto. The success which has attended the operation of the Hamilton, Grimsby & Beamsville road affords strong foundation for the belief that a system of radial lines, having as their terminus in Toronto an extensive and well managed public market, would be certain to prove a paying investment.

Niagara Power. BUFFALO capitalists are reported to have engaged the President of the Franklin Institute, Mr. John Birkenbine, to prepare plans for the utilization and transmission of 35,000 h.p. from the Whirlpool Rapids below Niagara Falls. At this point, where the speed of the current is 21.75 miles per hour, it is proposed to divert five per cent. of the flow of water through a canal to be built inside the tracks of the Gorge road. The scheme is no doubt a feasible one. The greatest problem would seem to be to find a profitable market for so much power in addition to that which is now being produced at the Falls. Representatives of New York and Philadelphia capitalists waited upon the Commissioner of Queen Victoria Niagara Falls Park on the 4th inst. for the purpose of seeking to acquire the power franchise now held by the Cataract Construction Company, in case the present holders should forfeit their rights.

Fires from Electric Wires. EITHER maliciously or through ignorance, the Fire Commissioners of Montreal have, in their annual report, endeavored to injure the business of electric lighting in that city, by attributing to defective wiring the bulk of the fires which occurred in buildings in the year 1898. The statements made by the commissioners are so unreasonable as to require no refutation by the trade, and it is probable for this reason that no action has been taken. Of a total fire loss during the year of $1,382,753, the commissioners attribute to electricity a loss exceeding $1,000,000, in the following words : "During the last year from this source alone the losses by fire have been greater by over $1,000,000 than from any other causes." The statement made is absolutely and unqualifiedly untrue. There is no basis or warranty for the statement that electric wires have caused greater losses than other causes, and particularly is there no basis for the statement that the losses from electric wires have been greater by one million dollars than by any other causes. If the statement concerning electric wires were true, then the losses from all other sources would be less than $383,000. The report states the number of fires investigated to have been 567 ; the number alleged to have been caused by electric wires 29, or only about 5 per cent. of the entire number. If the 29 fires alleged to have been caused by electric wires caused a loss of over one million dollars, that would mean an average loss per fire of about $35,000, whereas the losses from the other 538 fires would average only about $700 per fire. As a further evidence that the report is not based upon facts, we may say that the Fire Underwriters' Association at Montreal is not willing to incur the expense of a corps of inspectors for electric light wiring, and the insurance companies will not refuse to give insurance to parties who have not received a certificate from the Board of Fire Underwriters that their wiring is in accordance with the rules and regulations. The Board of Fire Underwriters do not believe that the danger to be apprehended, as determined by their experience in the past, is sufficient to warrant their incurring this expense, and in fact, the committee of the Canadian Electrical Association who have taken up the matter of underwriters' inspection have been unable to make any progress with the underwriters because of their apathy on the subject. If it were true that the 29 fires alleged to have been caused by electric wires had caused a loss of more than one million dollars the public might rest assured that in self defense the underwriters would take hold of the matter vigorously ; as it is, the only inspection that is insisted upon is that which the operating companies themselves undertake to apply. We trust we have said sufficient to show the utter absurdity and untruthfulness of the report. We observe that the Canadian Fire Underwriters' Association has submitted a memorial to the Montreal City Council urging that body to obtain the necessary legal authority to have all electric wiring executed under the supervision of an inspector, to be paid by means of a small inspection fee. It is very improbable that any resistance would be offered to the course by the competent wiring contractors, who are equally interested with the public and the insurance companies in securing perfect work. Those unable to do such would be forced out of the business, to the advantage of all concerned.

Canadian Electrical Association. THE Executive Committee of the Canadian Electrical Association especially desire that the coming Convention, to be held in Hamilton, Ont., in June, shall be of the utmost practical value to every member, whether operator, manager or owner of an electrical enterprise. With that purpose in view, it is intended that the subjects of papers to be read and submitted for discussion shall be those which appear to the members to be of most interest and of practical utility. Request has been made of the members to advise the Secretary what topics they would like to have discussed, and from what point of view. Already a number of valuable suggestions have been received, as well as the promise of several papers. A meeting of the Executive Committee will be held at an early date to consider the necessary arrangements for the approaching meeting and appoint sub-committees to carry them into effect. It will be remembered that Hamilton was the scene of the first convention of the Association. Since then the city has become the home of many important electrical enterprises. The Hamilton, Grimsby & Beamsville Electric Railway stretches a distance of more than twenty miles through the vineyards and orchards of the Niagara Peninsula ; the Hamilton & Burlington Electric Railway operates between the city and the far-famed Burlington Beach ; the Hamilton & Dundas Electric Railway affords the visitor views of the picturesque Dundas Valley. The Bell Telephone Company's exchange, which so interested the members at the former convention, has since undergone many improvements, and is an up-to-date object lesson in telephony. In addition to these and other interesting features of the city which might be mentioned, full opportunity will be given to inspect the entire equipment of the Cataract Power Co., described and illustrated in these columns recently. Those of our readers connected with any department of the electrical industry, who may not yet have become members of the Canadian Electrical Association, should join now, and share in the pleasure and profit of the approaching convention.

The Corporation of the Town of Bothwell have awarded a contract to the Canadian General Electric Co., for a 500 light plant, to be used for commercial and street lighting purposes. The lighting of the streets will be done by 15 enclosed arc lamps, of the latest type, which will be operated from the same machine.

MONTREAL

(Correspondence of THE CANADIAN ELECTRICAL NEWS.)

SUBMARINE TELEGRAPHY.

Dr. A. E. Kennelly, of Philadelphia, delivered four lectures at McGill University on January 30th and 31st, on "Submarine Telegraphy." The lectures were extremely interesting, and were largely attended, not only by students of the University, but by electrical people of the city. I am indebted to Prof. Owens, of the Electrical Department of the University, for the following brief abstract:

The history of submarine cable telegraphy is replete with interest, not only to the student of electromagnetics, but also to the student of sociology. Its annals indicate the immense amount of labor which has had to be expended by a large number of men in the best years of their lives' work, in developing conjointly the knowledge and experience which now enables us to set geographical time and space at defiance.

Practically all of this work has been accomplished during the last half of the century which is now about to close. The first submarine cable stretched timidly across the Straits of Dover about the year 1850, consisting of but a single copper wire, insulated with gutta percha. It had no mechanical protection of any kind. Although the cable lasted but a few hours, being destroyed either by the violence of the elements or the hook of an unkind fisherman, nevertheless it demonstrated its electrical capabilities, and paved the way for greater successes in the years to come.

It was not long before shallow water cables spread themselves around the shores of the Mediterranean, and in 1859 the first cable bridged the depths of the Atlantic. This was, indeed, a triumph of electrical engineering at that time, but the triumph was short lived, since the cable died a natural death in a few weeks' time. It was replaced, however, by a far better cable, in 1866, the experience of the earlier trial having come to fruition, and since that time Europe and America have never been beyond speaking distance.

At the present time there are some 150,000 miles of cable laid throughout the world, and a fleet of more than thirty telegraph ships is employed to minister to their needs. Although this length of cable would be sufficient to girdle the world some six times, yet the actual girdle is incomplete at present, at the Pacific ocean, but it is now confidently expected that ere long this gap will be completed by a cable from the western coast of America to China or Japan.

The amount of the capital which has been expended in the enterprise of cable laying will be evident from the fact that cable costs roughly about one thousand dollars per mile.

Enormous improvements have taken place in the speed of signalling or telegraphing through cables, since the ocean was first spanned, a great deal in this direction being due to the inventive skill of Lord Kelvin. The mirror galvanometer instrument, which is so valuable an adjunct in the electrical laboratory, has been yet more valuable to the electrical fraternity in the operating room, as a commercial signaling instrument, while the siphon recorder of later date has caught the fitful flickerings of the beams of light, and has left their record traced upon a moving band of paper.

There is no difficulty in laying a cable anywhere, but there is a considerable difficulty in laying a cable in such a manner as to minimize the risk of its fracture after being laid. It is a matter of experience that wherever a cable rests upon a rock, it will break, and its rupture is only a question of attrition and time. Those who build upon rock, so far as cables are concerned, build to their destruction, while only those who build upon sand can expect dividends. The course on which a cable is to be laid should be thoroughly investigated beforehand, by a ship which makes a zig-zag path over the course, and sounds at frequent intervals so as to insure the provision of a smooth and soft bed, on which the cable shall be laid to rest, otherwise its slumbers will be interrupted by the rude shocks of rupture.

The size of a cable, and therefore to some extent its cost per mile, varies with the depth of water and the nature of the bottom. In deep water a cable is made slender and light; in shallow water it is made of relatively great weight and diameter, with large protecting steel wires to resist attrition.

The speed of signaling does not become any serious consideration until a cable is several hundreds of miles in length; in other words rapid speed of hand signaling can be obtained over almost any kind of practical submarine cable up to a length of several hundred miles, but after a length of, say, five hundred miles has been passed, it is necessary to employ delicate apparatus, and with long cables it is necessary to employ a comparatively large size cf copper wire or strand conductor and insulating gutta percha envelope.

There is scarcely any series of engineering operations which has a greater fascination or possesses more romantic interest than submarine telegraphy, in the picking up or repairing of cables. It is governed largely by time and tide and weather, and its fortunes are governed by a great variety of circumstances; nevertheless, cables have been successfully repaired in the deepest water to which they have yet been committed. The expense of repairs in deep water, say in two miles of water, is naturally much greater as a rule than the expense of repairs effected in shallow water, while in some cases very shallow water repairs may be effected in a small boat or sailing yacht, at an expense that is relatively trivial.

COMPETITION FROM UNITED STATES.

We are credibly informed that the contractors for the new London & Lancashire Insurance building, themselves American, have engaged a Boston firm to do the electric light wiring. While this is a matter more nearly affecting Montreal electrical contractors, it evidently affects all Canadian building contractors to know that whilst American workmen can be brought over here, literally taking the "bite out of the Canadian workman's mouth," the alien labor law prevents our returning the compliment and sending our men to do work in the States. Surely "what is sauce for the goose is sauce for the gander," and there should be some way of remedying such a glaring anomaly. The sooner our contractors see to it the better for their own intererts. "Verb sap."

QUESTIONS.

"Subscriber" writes: "I have a General E'ectric induction fan motor, 16,000 alternations, 52 volts. Tried to run it on 8,000 alternations, 52 volts, by putting kicking coils in series. Kicking coil wound with same size of wire as fields of motor. Leaving the matter of speed out of the question, why should armature of motor heat excessively after a short run, and fields remain cool? On 8,000 alternations, with kicking coil in series, armature appears to be a block of laminated iron with pieces of No. 10 copper wire threaded through."

"Doctor" asks: "Why does sparking with explosive reports happen in mercury cup of Rumkhoff X-ray apparatus? Six cells of accumulators are used, and a subsidiary battery of two cells to work interruptor. Main current appears to enter the Rumkhoff coil via the pillar of the interruptor and mercury contact cup, in which a pointer, attached to arm of interruptor armature, dips. On top of the mercury in cup is placed a layer of alcohol. When interruptor and coil are in action, loud sparks are heard in cup, accompanied by flashing in the Crookes tube.

THE VOLTAGE MAGNIFIED.

In your Montreal news in January there is surely a slight inaccuracy in the item "A Charmed Life." The wire was amply large enough, no matter what its size was, to carry 2,500 volts. The current which it was carrying in amperes was not mentioned, but it would not take much of it at pressure named to seriously injure a man. That the voltage received was actually 2,500 is very much open to question. There was iron wire acting as a conductor, which in itself had considerable ohmic resitance, not to speak of its kick-back effect with alternating current; further, the original contact was probably of an arcing nature, and by no means what might be called "good contact."

THE FIRE COMMISSIONERS' REPORT.

Your correspondent had hoped that an official refutation would have been given before now to the late report of our Fire Commissioners, so far as amount of damage said to be caused by electric wires is concerned, but it has evidently been treated with the silent contempt that such an extraordinary statement merited. The Commissioners must say something to retain their sinecures, and evidently act on the rule "when in doubt, blame electricity." For the satisfaction of your readers, I have interviewed one of the inspectors (whose name, for obvious reasons, I do not give), and one who is competent to give an opinion on this subject, which, with all due deference to them, our noble Fire Commissioners are not. His answer was that "that portion of report was simply ridiculous"—to which I must heartily say "Amen."

NOTES.

One of the "deadly electric wire" fires chronicled in the daily press here as having occurred at the Balmoral Hotel turns out to be from grease upset on a stove. As the idea is popular, however, none of the papers have had the temerity, so far, to make retraction.

The plant mentioned in your "Sparks" column, January issue, for the C.P.R. steamship Alberta, is well under way, the dynamo and switchboard being supplied by the Canadian General Electric Company, and the wiring being executed by the Montreal Electric Company.

Mr. P. H. Hover, representing the New York Insulated Wire Co., was in Montreal lately, reminding his friends of the fact that rubber covered wire is "moving up," and that rapidly. He seemed to have his pockets well filled with orders, judging by his jovial smile.

Mr. White-Fraser apologizes for his late comments on the London specifications. Although late in one sense, they are indeed timely, as, judging by conversation here, your correspondent can safely say that he has struck the mark by calling a "spade a spade," and the trade applaud his criticism.

Mr. S. A. Chase, of the Western Electric Company, New York, was in Montreal last month. He reports business booming, his company having lately purchased more land and intend building at once a factory larger than either that on Thames street or Bethune street. Mr. Chase is managing the Canadian Bryant Company's factory in Montreal at present.

Mr. Hallberg, of the Standard Thermometer Company, of Peabody, Mass., paid a visit to this city a fortnight ago. He spent most of his time at the headquarters of his Montreal agent, Mr. John Forman. Mr. Hallberg is a Swede by berth, and well posted in matters electrically. He is the inventor of the Upton arc lamp, enclosed type, which is already to be found in many places of business in Montreal.

Of ill luck the Lachine Rapids Hydraulic & Land Company have had more than their share. After keeping up service through particularly trying weather, such as 20° below zero one day and 40° above the next, they have had their "head" lowered by a jam occurring, which has raised the water, and which does not seem to want to move off quickly by aid of nature alone. It is hard luck, and they have the sympathy of the public at large; meanwhile, "it is an ill wind that blows nobody good," and the Royal Electric Co., their opponents in the field, are reaping the benefit of the misfortunes to the Lachine Co., which, however, now appear to be about at an end.

SYSTEMS OF METER RATES.*

By Edwin L. Debell.

THE study I have been able to give this subject has greatly increased its importance in my estimation, and impels me to urgently advise all central station operators to give it more serious consideration than it has yet received. We all know that our properties are operated at a poorer rate of economy than any other class of power plants, being in effective operation only a few short hours out of each twenty-four. Have we given due consideration to the cause of this defect; what means, if any, be employed to remedy it, and a surprising amount of benefit would result thereby to ourselves and our customers? I think not, and the object of this paper will be an attempt to show how these conditions are effected by the systems of rates employed.

The contract, or flat rate system, although still in quite extensive use, is neither logical or satisfactory. In the early days of electric lighting the service was employed mainly in the business places, and only the number of lights needed for regular daily use were installed; lamps were all of one size, and the station usually run until twelve or one o'clock at night. Under these conditions, flat rates were fairly successful, and could not be greatly abused. The fixed charges on the property, however, were very high for each hour of operation, and high rates had to be charged.

Nowadays the use of the service is more varied. Business places require a large number of lights for display and other occasional use, and we are called on to supply current to dwelling houses, shops, churches, halls and other intermittent consumers. Lamps are supplied in sizes from 2 to 50 c. p., and most of our stations are now operated all night, if not the entire twenty-four hours daily. Under these changed conditions, the flat rate privileges can be, and are, grossly abused. The central station is not only compelled to supply a large quantity of current for which no pay is received, but also to invest additional money in machinery to supply it.

The justice of charging each customer for the exact quantity of current used, and the employment of suitable devices for ascertaining that quantity, cannot be questioned. The number of recording meters installed within the past few years, and the constantly increasing use of them, indicates clearly that this is generally accepted as the true basis on which to frame the charge for electric current.

This proposition being accepted as true, we now come to the main question involved in this paper. What system of rates will be most just and satisfactory to our customers, and at the same time maintain and improve our present earnings?

First, let us study prevailing methods and see if they are foundded on the true cost of production. The usual custom is to charge a fixed rate per unit, with discounts proportionate to the quantity used. The rate per unit has been determined either by the present average cost of the total units produced, by estimation, or by the rates in most general use by others. In any case, the cost has been made to include all fixed expenses on the property, such as interest, taxes, insurance, management, clerical work, etc., and which generally amount to 75 per cent., or more, of the total cost of each unit produced. As the great bulk of the station's output is accomplished in three or four hours of heavy load each day, a like proportion of the fixed expenses are charged against that period. Thus, according to our own calculations, each of the remaining twenty or twenty-one hours has to stand but a small fraction of the fixed expenses, yet we charge our customers the same amount for each unit used in those hours as in the heavy load period. The process is one of average, and does not distribute the expense ratably to each customer.

It may perhaps be claimed that the process is fair on account of the manner in which we have to operate our stations, but it is a matter of great doubt whether this manner of operation is responsible for the present system of rates, or if the rates are responsble for the poor operation.

When we charge nearly all of our fixed expenses against the current used during a few hours, and then assess it again on each unit used in the remaining hours, it makes the cost of the service especially burdensome, if not prohibitive, to those using it for long hours at a time. These customers are the most valuable to the central station, and should be encouraged by every possible means. We should do everything we can to keep them, and to secure more of them, as they keep our investment employed a longer time each day and add to our receipts, without any increase whatever in our fixed expenses, and very little in running expenses.

Let us study how a system of differental rates would affect this question. In order to apply such rates we first have to determine the total cost of production per unit, including fixed and running expenses of every kind. Next determine how much of the cost is for fixed expense and how much for running expense. If exact records of the costs have not been kept, a close enough estimate can undoubtedly be made to answer the purpose. It will be found that the running expenses form but a surprisingly small portion of the whole. This is not a supposition or guess work, but has been proved by the records of many well conducted stations.

The report of an examining board to the authorities of Aberdeen, Scotland, in 1897, gives some very interesting arguments on this feature. They refer to the poor fate of economy of the electrical plant owned by that city, and compare it with their gas works. They show that the former has to install and hold ready for use generating machinery sufficient to meet the maxium requirements of all their customers at any given moment; that their plant had a capacity, if run twenty-four hours daily, the same as the gas works, sufficient to supply three and three-fourths millions units per year; yet in the preceding year, only 214,000 units, or less than 5¾ per cent. of the capacity of the works, had been supplied. A load diagram of the station was shown, almost identical with those common to our own stations. The opinion of the board was that this unfavorable condition would be improved by a varying or differential system of rates, based on the true cost of production and giving discounts according to value of the customer to the station, in contradistinction to the total quantity consumed.

They submitted a statement showing a comparison between their best and worst customer for the preceding year. The best was a comparatively small consumer of current, employing less than two horse power of the station's capacity, less than $400 of its capital, and chargeable with but $27.50 of the annual capital

* Paper read before the Northwestern Electrical Association.

charges. He employed the service for 2,000 hours during the year, however, producing a revenue of $288, or about $260 over capital charges.

The other employed 177 h. p. of the station's capacity, nearly $37,000 of its capital, and was chargeable with $2,582 of the annual capital charges. He used the service 61 hours during the year, paying therefor $823, or less than one-third of his portion of capital charges.

These are undoubtedly extreme cases, one showing a very large load on the station for about twelve minutes, and the other a small load for six and two-thirds hours per day for 300 days in the year. The system of rates recommended by the board would compel the larger customer to pay a very much higher rate, or to abandon the service and make way for customers of the other class, who would be encouraged by the lower rates the system would give them.

Mr. Arthur Wright, electrical engineer to the corporation of Brighton, England, and originator of the Wright demand indicator, gives some figures covering the ratio of fixed and running expenses in the Brighton plant, in a phamplet published in 1896.

To show what a small portion of the total cost of production lies in running expenses, and why it follows that the output of a station can be enormously increased with only a small addition to total expenses, he has selected and given figures on two periods of three months each, one ending July 31, and the other Dec. 31, 1895. In the first period the cost of coal and engine stores amounted, in round figures, to $2,500, and the station supplied 110,000 units. In the other period, coal and engine stores cost $6,000, and the station sold 366,000 units. The fixed expenses were alike in each period, and with the possible omission of some unimportant items, the running expenses were increased only $3,500 to increase the output of the station three and one-third times. The company's record show that of the total cost of operating the Brighton plant in 1895, less than one-sixth part was for actual running expenses. This is the ratio, with coal at $2.50 per ton, and Mr. Wright states that at the lower cost of coal in nearby towns, it would be less than one-ninth.

To come back to the application of the differential rates. After fixed expense has been determined, a ratable portion should be charged against each customer. A number of devices have been introduced to determine this ratable portion, further reference to which will be made later on. A sufficient rate is to be charged to cover both fixed and running expenses, until the customer has paid his share of fixed charges, after which the rate may be reduced so as to cover only the running expense incurred in supplying him, with, of course, a reasonable profit added. The plan does not necessarily reduce rates, except to such customers as are found profitable at reduced rates. Those who use a large quantity of current at different and irregular intervals, or whose demand is largely during the hours of the station's heavy load, would not be affected in that way, and by the use of some of the devices employed the most undesirable of such consumers would be subjected to a higher rate. The tariff may be arranged to suit varying local conditions, as in present methods.

The main object to the differential rate, and which, if accomplished, is obviously of the greatest importance to all central stations, is to induce longer hours for our product, and enable us to make special low rates to those who can find use for current during our slack hours. Our best customer is he who employs our capital the greatest number of hours per day, and our present rates are calculated to repulse, rather than encourage him. He now uses as little current as possible, and that usually at the time when it is most valuable to the station. The remainder of the time, when we would be making most profit, even at a low rate of charge, he "pieces out" with other kinds of light or power.

How plain it is to us when we pass a store in the evening and see in use only a few of the electric lights installed, that our revenue from that store is but a fraction of what it used to be, while our expenses go on the same as before. We feel this still more acutely when we see our service dispensed with entirely, and who of us can say that such sights are uncommon? Observation will prove that those most inclined to give up the service are meter customers running long hours, the very ones the station can least afford to lose.

In considering the adoption of differential rates, local conditions should be studied. If little or no demand can be found for current during the station's slack hours, even at a very low rate, the success of the system would be doubtful. If, on the other hand, a large demand could be worked up, the system would be highly profitable to the station and prove satisfactory to the public. The hours of effective operation would be increased, without any increase at all in fixed expenses. So large a part of the total cost is incurred in getting ready to supply current, and so little in actually supplying it after the machinery is started, that if central stations could be operated continuously up to their capacity, they could produce current so cheaply as to render competition out of the question. Of course, this is an ideal condition and will probably not be reached in the near future, if ever. It should be possible, however, to improve existing conditions to quite a large extent, and think we should not cease our efforts until we have found work for our stations that will materially increase their output through prolonged hours of operation. It seems clear that only by this means can we increase our business or even hold what we now have. If we can accomplish this, even to a moderate extent, it will so decrease the cost of production per unit that each of our present consumers could have more current at the same, or less, cost than now, and the remainder, even if sold at a very low rate, would bring sufficient revenue to largely increase the station's profits.

New business for our maximum load period will not accomplish this, as it entails an almost proportionate increase in fixed charges and does not extend the hours of operation. A system of rates giving the service, to customers who can use it outside of rush hours, at prices they can afford to pay, seems to be the most logical and feasible way. It may not appear an easy matter to find such customers, but if we first thoroughly inform ourselves how extremely low we could really afford to make the rates for a fair quantity of this class of business, the difficulty would not appear so great.

As to the devices intended to carry out the plan of differential rates, they are of several forms. The Wright demand indicator, as its name implies, records the greatest amount of current issued by a customer at any one time, the theory of its use being that such maximum demand on the station should regulate the portion of fixed expenses to be borne by the customer. It is assumed that the customer will use his maxmium demand a certain length of time each day, coincident with the maximum station load, and for that much of the total amount consumed he should pay a rate sufficient to cover fixed and running expenses. For the balance consumed, as shown by the usual recording meter, a lower rate is charged.

The double recording, or two-rate meter of the General Electric Company, appears to be their regular type with the addition of an extra set of dials and a clock mechanism. The clock is wound half-hourly by the action of current, and may be set so as to cause the meter to register on set of dials all the current consumed during any predetermined period, and on the other dials at all other hours. The theory of the use of this meter is that a customer's portion of the fixed expense should depend on the total amount of current he uses during the station's heavy load and a lower rate be charged him for all consumed at other times.

It is claimed that it enables the customer to use current liberally during all the hours of the station's light load. Although costing about $25 more than the simple recording meter, it possesses the good quality of performing the entire work without the aid of any other device. The customer can readily see how much each of high or low rate current he has used, and it is adapted to use on both direct and alternating systems. It has a mild tendency to prevent a heavy load during the station's rush hours, but not in the remaining hours when heavy consumption is rather desirable than objectionable.

The Oxley multiple rate meter controller, described in The Electrical Engineer of January 18, 1898, is a small electro-magnetic switch, to be installed at each point of consumption, and to be operated by a controlling switch in the central station. It may be used in connection with two recording meters, closing the circuit in one or the other at the will of the station operator by his manipulation of the station controller, or it may be used with a single recording meter, in which case it employs resistance to retard the speed of the meter during the low-rate period. The theory of its use is the same as that of the General Electric Company's two-rate meter, although I am informed it cannot be applied to alternating systems.

No attempt is made herein to give a technical or lengthy description of these devices, more than a brief mention of them, as means with which to carry out the differential rate system would be of no practical value in this place. If any of you wish to consider such a method of rates, you will want to study the various devices yourself, and decide upon their relative merits according to your local conditions.

The theory of differential rates may be applied in a modified

orm with the use alone of the ordinary recording meter. Mr. Thayer, of Belle Plaine, Iowa, describes a plan in The Electrical Engineer of December 23, 1897, stating that he had then been using it for about a year, and that it had been highly satisfactory in the cases to which it is adapted. He appears to have adopted it largely in order to avoid straight flat rates, and does not refer to it as a differential rate plan, yet it appears to be somewhat on the same lines.

To a customer who installs more lamps than are needed for regular every day use he makes a fixed charge of 33 cents a month for each light used during the hours of the station's maximum load, and 5 cents besides for each kilowatt hour consumed. The 33 cents may be considered a charge for fixed expenses, incurred in getting ready to supply him with current, and the 5 cents per kilowatt hour a charge for running expenses after the machinery has started supplying him. Mr. Thayer states that this plan has proved a good one for a large class of his customers. It prevents any wide variation in the monthly bills, which is a frequent source of complaint from customers during the winter months. At the same time, the certain revenue of 33 cents per light will, in most cases, cover fixed expenses, and the 5 cents per kilowatt hour a reasonable return for the service. It does not make the charge burdensome to the customer burning long hours, the very one we should seek to get. The monthly charge for a light burned daily two hours would be 48 cents; four hours, 63 cents; eight hours, 93 cents, and twelve hours, $1.23. Thus, a customer using lights until 9 o'clock p.m. daily throughout the year would burn about two hours per day in the middle of the summer, making the cost per light 48 cents, and about five hours per day in the middle of the winter, costing about 70 cents, or an average the year round of a trifle less than 60 cents per month for each light.

A device such as the Wright demand indicator should be useful to stations selling current on the flat rate plan. Monthly rates could be made for each individual or class of customers, based on the greatest number of lights they would use at any one time, an additional charge to be made if that number should be exceeded.

In case of dwelling houses, notice could be given the station when a large number of lights were to be used on special occasions, and the indicator could afterwards be reset. This would give the station knowledge of the frequency and extent that lights were used in excess of the agreed manner. It would check waste of current to a large extent, and reduce the maximum loads, especially in dwelling houses, where it is most serious, under the flat rate plan. The maximum station load would also be reduced, increasing its capacity and earning power, by making room for more customers with the same amount of machinery and coal consumption.

Any of the foregoing methods embody the differential rate theory in a greater or less degree, and should result in improved efficiency in the operation of our stations. If the system cannot be adopted in its entirety, some features of it might be applied that would meet local conditions more nearly than present methods, and work alike to the satisfaction of customers and the benefit of the central station.

To my mind, the question merits the careful study of every station operator, and is of so much importance that if we fail to give that study voluntarily, the trend of our business will force it on us sooner or later.

SPARKS.

Angus H. G. MacDonald, city electrician of Halifax, N.S., is dead.

The British Columbia Electrical Supply Co., of Rossland, B.C., is applying for incorporation.

The town of Liverpool, N. S., purposes installing an electric light plant, tenders for which have not yet been invited.

The city council of Montreal have decided to purchase a new boiler for the upper level pumping station.

The Dominion Coal Company, of Nova Scotia, propose doing away with horses for hauling purposes, and will utilize electricity entirely.

A shipment of 110 barrels of mica, valued at $6,000, was forwarded recently from the St. Anthony mines, near Ottawa, to W. H. Sills & Co., of Chicago.

The Grand Jury in the Criminal Assizes, Toronto, in their presentment, recommended that a boiler of larger capacity be purchased for heating the jail building.

The corporation of Peterboro', Ont., will ask the Ontario legislature for permission to acquire and develop water power on the Otonabee river, and to supply light, heat and power.

As a result of the boiler "sagging," the streets of Port Arthur, Ont., were recently without light for a short time. It is probable that another boiler will be added to the plant in the near future.

The War Eagle Mine expect to operate their works by electricity this month. Power will be furnished by the West Kootenay Power and Light Company, from their generating plant at Bonnington Falls.

The city of Halifax, N. S., invites tenders up to Wednesday, March 8th, for the supply of an electric light plant for lighting the streets and public buildings of the city. Particulars may be obtained from Mr. F. W. W. Doane, city engineer.

The Imperial Oil Company has absorbed the Bushnell Oil Company and the Eastern Oil Company, and a monopoly of the oil business of Canada is thus practically secured. The head offices will remain in Petrolia, while the Queen City Oil Company, Toronto, will continue to handle the Ontario business. Mr. C. J. Mills, the present manager of the Imperial Company for western Ontario, will be general inspector in Toronto.

J. B. Loyer, of New York, has purchased the Gold King mica mine at East Templeton, Que., and intends developing it.

The ratepayers of the village of Bradford, Ont., have voted down a by-law to raise $6,000 for installing an electric light plant.

A by-law to raise $67,750 by debentures for the purchase of the gas and electric light plants of a private company was defeated by the property owners of Galt, Ont., on January 9th.

The residents of Birchton, Ont., are endeavoring to make an arrangement with the Metropolitan Electrical Company, of Ottawa, to supply that village with electric light.

Mr. A. A. Dion, general superintendent of the Ottawa Electric Company, recently gave an interesting talk on "Electricity" before the Literary and Scientific Society of Ottawa.

The town council of Toronto Junction is considering the advisability of adopting an all-night service and of putting in additional plant to permit of supplying incandescent lighting.

A by-law has been approved of by the Lieutenant-Governor-in-council permitting the town of Fort William, Ont., to issue debentures to the amount of $11,000 for extending and improving the electric light plant.

The Fire, Water and Light Committee have recommended that the council of Rat Portage, Ont., take steps to purchase the electric light plant from the Citizens' Telephone & Light Company.

It is said that J. R. Booth will build a power house at the Chaudiere, and that an electric plant will be installed therein capable of operating all the machines in the shops at the deep cut and of supplying the required light.

The Stanstead, Que., Journal of recent date says: "The acetylene gas apparatus at the Marbleton Hotel exploded last Friday, setting fire to the hotel and destroying apparatus. Landlord Cote had a narrow escape, and others who assisted in extinguishing the flames were badly burned.

A deputation from Morrisburg, Ont., intervied the Dominion government recently with a view of obtaining water power from the Morrisburg canal to operate an electric plant for the town. A Lindsay deputation has asked for similar privileges from the Trent valley canal.

The Winnipeg Electric and Gas Light Co., now supplying the city with electric light, have been asked to submit a proposition for supplying 125 arc lights for another year. A motion that tenders be invited for electric lighting for a period of five years was voted down in council.

The annual meeting of the Canadian Rubber Company was held in Montreal last month, at which directors were elected as follows: A. Allan, president; H. McLennan, vice-president; H. M. Allan, W. H. Benyon, F. Scholes, J. B. Learmont, Andrew A. Allan, C. P. Smith and J. O. Gravel.

E. S. Jenison has completed the surveys for his power canal from Kakabeka Falls to Port Arthur. It is said that 100,000 horse power can be developed. The reservoir will be a large lake 4 miles long, covering an area of 4,000 acres, with a depth of 50 to 75 feet. Its surface will be 303 ft. above Lake Superior.

At the annual convention of the International Association of Fire and Police Superintendents and Municipal Electricians, to be held at Wilmington, Del., in September next, Mr. George F. MacDonald, of Ottawa, vice-president of the society, will read a paper on "Progress and Development of the Municipal Electric Interest of Canada."

A large driving pulley in the power house of the Ottawa Electric Railway Co. flew to pieces recently, badly wrecking the interior of the station. Michael Leroux, who was in charge, escaped uninjured. The wheel weighed 7,700 lbs., was 97 inches in diameter, and 52 inches across the face. The accident is said to have been caused by a flaw in the wheel.

The steamer Pro Patria of Halifax, is being equipped electrically, and for the purpose of lighting the steamer and operating searchlight, an order has been placed with the Canadian General Electric Company for the complete outfit, which will consist of one of their standard C. G. E. direct connected equipments, including engine, dynamo, switchboard, searchlight, and wiring complete.

Mr. Wells, manager of the St. Catharines Electric Light Co., has recently gained some notoriety. Mr. Quinn, proprietor of the Russell House, St. Catharines, changed the combination of his safe and locked it before making note of the numbers. He was informed by the safe manufacturers that the combination could not be worked out, it being a five-numbered one and impossible of solution. This fact becoming known to Mr. Wells, he volunteered to open the safe, and in two hours his efforts were rewarded by the combination working out.

A conference of manufacturers of carbons was held in Chicago on January 12th, as a result of which a carbon trust may be formed, with a capital of $10,000,000. It is said that the following companies in the United States are in the combine: The National Carbon Company, Cleveland, Ohio; Brush Carbon Works; Standard Carbon Works; Crouse & Tremaine Carbon Company, Fostoria, Ohio; Thomson-Houston Carbon Company, Freemont, O.; Faraday Carbon Company, Jeannette, Pa.; Phoenix Carbon Company, St. Louis; American Carbon Company, Noblesville, Ind.; Washington Carbon Company, Pittsburg; Partridge Carbon Company, Sandusky, Ohio. It is further stated that the syndicate will own a half interest in the Ottawa Porcelain & Carbon Company, at Ottawa, which controls the carbon industry in Canada.

SPARKS.

The electric light plant for the new Victoria hospital at London, Ont., has not yet been purchased.

The Canadian General Electric Company, Toronto, are again to the front with one of the prettiest lithographic calendars which has yet come to our notice.

The Canadian General Electric Company have recently sold a 50 light dynamo to be installed in the premises of one of their customers at Edmonton, N. W. T.

The city council of Hull, Que., received tenders up to February 6th, for the supply of an electric light plant. The tenders will be opened by the council on the 17th instant.

The process used by the National Electrolytic Co., of Niagara Falls, N. Y., for the production of chlorate of potash, is the invention of Mr. T. Gibbs, of Buckingham, Que. The details of the process are kept a secret.

The Hawthorn Woolen Mills Company, of Carleton Place, Ontario, are increasing their lighting plant, and have placed their order with The Royal Electric Company for one of their 25 k. w. bi-polar direct current generators.

An arrangement was consummated on January 20th for the sale of the Edison Electrical Illuminating Company, of New York, to the New York Gas and Electric Light, Heat and Power Company. The issue of bonds will be limited to $21,000,000.

The Canadian General Electric Company have recently sold to Messrs. Evans & Hastings, printers, Vancouver, B. C., a 6 kilowatt Edison dynamo, and to Braid & Company, of same city, a 10 h.p. motor for use in their spice mills.

The E. T. Wright Company, of Hamilton, are having installed in their factory a 50 h.p. S.K.C. motor to drive their machinery. The power by which this motor is driven is taken from the Cataract Power Company's wires. This is the tenth installation from their service into factories in Hamilton up to date.

The directors' statement presented at the annual meeting of shareholders of the Toronto Electric Light Company, held a few days ago, was of a satisfactory character. It showed the payment of four quarterly dividends at the rate of 7 per cent. per annum, with a small balance carried forward to the credit of profit and loss account.

The Montreal Water & Power Company, of Montreal, are installing in their pumping station a 400 h.p. S.K.C. two-phase motor, operating at 180 r.p.m. This motor is intended to operate the water works pumps, and will be driven by current generated at Chambly Rapids, a distance of sixteen miles away. This is one of the largest single motor installations in Canada.

The Royal Electric Company have received an additional order from the Hamilton Electric Light & Power Company for a 500 h.p. S.K.C. two-phase synchronous motor, which will operate a shaft driving their arc circuits and street railway power circuits. This is an addition to the 350 h.p. motors noted in these columns in our last issue. The first of the two mentioned has been in operation for some time with perfect success.

Mr. M. Hutichson, superintendent of the municipal electric light plant at Victoria, B.C., refers in his annual report to the breaking of the terminal wires in the armatures, the main cause being excessive floor vibration. To remedy the breaking off of lamp loops during windy weather, he recommends that flexible safety loops be placed on all lamps in exposed positions. The total number of lamps now in use is 230, and the annual cost per lamp per annum, exclusive of interest and sinking fund, is given as $53.

The Metropolitan Electrical Company, of Ottawa, are about to proceed with the development of their water power at Britannia, Mr. George A. Wanless, the secretary-treasurer, having invited tenders for the excavation of canal and wheel pits, and the construction of dams, cofferdams, cribwork, flumes, embankments, roads, masonry, concrete work, etc. The company will probably erect a transformer station near the Maria street bridge, and will transmit the current at a pressure of 10,000 volts. The entire plant will cost probably $250,000.

The corporation of Barrie, Ont., has engaged Mr. Roderick J. Parke, E.E., of Toronto, for a period of one year, to take charge of the re-arranging and re-construction of the electrical lighting system recently purchased from the Barrie Electric Light Company, and to supervise its operation. About $15,000 will be expended in additions and improvements; among the additions will be a 2,500 light alternator, an 80 light arc generator, 65 arc lamps for street lighting, 125 h.p. engine, and an extension to the present station building. The street distribution lines will be replaced by modern and efficient construction. A 15 station fire alarm system will also be installed at an early date.

The Canadian General Electric Company report the following recent sales: To the Comstock Concentrator, of Silverton, B. C., a 25 light Edison dynamo, to be used in lighting their premises; to the Athabasca Gold Mining Company, of Nelson, B. C., a 100 light Edison dynamo, to be used in lighting their buildings at the mine; to the Savoy Theatre at Vancouver, B. C., a 250 light incandescent lighting dynamo, of their multipolar slow speed type; to the Scottish Colonial Mining & Milling Company, of Three Forks, B. C., a 100 light 16 c.p. incandescent dynamo for lighting their buildings at the mine; to Messrs. McKenzie Bros., of Victoria, B. C., a 6 kilowatt Edison motor; to the B. C. Electric Railway Company, to be used in driving the blower apparatus in their power house, a 12 kilowatt Edison motor; to Messrs. Hoffmeister Bros., of Vancouver, B. C., a 25 light incandescent lighting dynamo; to J. C. Woodrow, of Vancouver, B. C., a 3 kilowatt Edison motor; to Messrs. Hinton & Company, of Vancouver, B. C., to be installed on a steamer navigating Lake Bennett, a 25 light incandescent dynamo

The Lambton Oil Company, Limited, of Sarnia, Ont., has bee incorporated, with a capital stock of $20,000.

At the next open meeting of Hamilton No. 2, C.A.S.E., Mr. Wm. Turbayne, E.E., will read a paper on "Arc Lighting."

The Westinghouse Electric Company, of Pittsburg, Pa., is reported to have placed orders for 60 boilers with the Babcock & Wilcox Company, of London, Eng.

The Guelph Light & Power Co. have recently purchased a new 1000 light single phase alternator from the Canadian General Electric Company, together with marble switchboard panels for the control of two machines.

The town of Essex is to have an incandescent system of electric lighting. Mr. C. E. Naylor, of that place, having undertaken the operation of the system, has purchased from the Canadian General Electric Co. a 750 light machine for the purpose.

Messrs Corley & Collins, of Mount Forest, have experienced such an increased demand for lighting during the past two months that they were compelled to increase their facilities, and have purchased from the Canadian General Electric Co., one of their standard 1000 light single phase alternators, with marble panel switchboard and exciter, for the purpose of meeting these requirements.

The town of Port Arthur, Ont., has been operating its street railway, which extends from Port Arthur to Fort William, at a loss, and will likely adopt a new schedule of fares. The present rates are: Cash fares, 5 cents; blue tickets, 6 for 25 cents; morning and evening tickets, 8 for 25 cents; school children, 10 for 25 cents. For one fare passengers are permitted to ride from end to end of the line—over seven miles.

Andrew Holland, of Ottawa, has prepared an estimate of the various water powers in the Ottawa valley. His calculation is as follows: Ottawa river, 664,000 h.p.; Rideau river, 1,300 h.p.; Mississippi river, 14,700 h.p.; Madawaska river, 20,600 h.p.; Bonnechere river, 3,400 h.p.; Petite Nation, 2,000 h.p.; Blanche river, 2,000 h.p.; Lievres river, 98,450 h.p.; Little Blanche, 300 h.p.; Quyon river, 100 h.p.; Coulonge river, 27,600 h.p.; Black river, 24,000 h.p.; Gatineau river, 31,675 h.p.; total, 890,225 h.p.

A copy of the prospectus issued by the Bedford Electric Company, of Halifax, N.S., is to hand. The company, which is capitalized at $250,000, proposes to install an electric plant at St. Margaret's Bay, to transmit light and power to Halifax and other points in the vicinity, and to furnish power for the operation of an extensive pulp mill to be erected. The transmission line will be 18 miles in length, and the pipe line from the power house to the dam about 4,000 feet in length. It is also proposed to operate an electric tramway to Halifax. Mr. M. M. Keefe, of Halifax, is president of the company, and Mr. A. E. Soulis, manager and secretary.

The Canadian General Electric Company have been awarded by the Department of Railways and Canals, the contract for the erection of a power house, and the complete equipment of the Soulanges canal with electrical apparatus, for operating the locks, by means of electric motors. The entire canal, covering a distance of 14 miles, will be illuminated by arc lamps. Owing to the success met with, by the Department, in the operation of electricity at the canal at Sault Ste Marie, Ont., as applied to the locks, they decided to make a more extensive application of the use of electricty, in the illumination and electrical operation of the locks of the Soulanges Canal.

A 6-inch belt, travelling through 4,000 feet of space per minute, will run machinery equal to a 24-inch belt only running at the rate of 1,000 feet per minute. A belt should never be laced too tight, for the belt will be hard upon itself. The motion that is produced between the pulley and the belt is maintained by friction. Belts laced too tight will cause friction to such an extent that it will consume all the power of engine. Under a given load, it is wonderful to see how much power of resistance there is in a good belt. It can be strained for months, and after a short period of rest will return to its original strength and length.

THE FIRST INTERNATIONAL ELECTRIC RAILWAY.

OTTAWA, January 28th, 1899.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In your issue for January, 1899, you state that the Niagara Falls Park and River Railway has the honor of operating the first international electric railway between the United States and Canada. This road began operations in 1898, the first car crossing on July 1st of that year.

There is another road which may fairly claim to be the pioneer. The Calais & St. Stephen Electric Railway has the right to the honor. The first car crossed the bridge over the St. Croix river (dividing Maine and New Brunswick), from Calais to Milltown, in July, 1894, and the first car over the bridge between Calais and the town of St. Stephen crossed in June, 1895. This would give the Niagara Falls Park & River Railway third place.

Yours truly,
GEORGE JOHNSON.

ELECTRIC RAILWAY DEPARTMENT.

A CHRISTMAS TROLLEY CAR.

The children of Ottawa appeared on the streets of that city in large numbers on Christmas eve last, to await the arrival of the Santa Claus car which has become such a welcome annual visitor, and which is responsible for gladdening many a young heart.

For some days before the event Mr. Soper, in whose mind the idea first originated, caused letters, under the signature of "Santa Claus," to appear in the Ottawa papers, to the effect that the writer (Santa) would visit Ottawa and go through the streets of the city mounted on top of an electric car, accompanied by a suite of brownies, and that oranges would be distributed to the children en route. The letter excited intense interest among the children, and during the progress of the car the principal streets were crowded. Santa Claus used a tally-ho horn to give the call, and the brownies created a great deal of amusement by their grotesque antics. Some 5,000 oranges were distributed. The car was not in any way an advertisement, but was simply the outcome of a desire on the part of Mr. Soper to afford amusement and pleasure to the youngsters of Ottawa.

Christmas Car—Ottawa Electric Railway Company.

A splendid illustration of the car, and portraits of the brownies, are presented on this page.

ANNUAL MEETINGS OF ELECTRIC RAILWAY COMPANIES.

THE TORONTO RAILWAY COMPANY.

The annual meeting of the shareholders of the Toronto Railway Company was held last month, at which the board of directors was re-elected. The report presented showed net profits for the year 1898 of $404,738, out of which $240,000 had been paid in dividends and $64,000 in mileage allowance, leaving a balance of $100,738. The receipts from the operation of the Sunday car service showed a steady increase, being $367.24 per Sunday greater than in 1897. During the year 30 closed and 20 open motor cars had been added to the rolling stock, and 40 additional open cars are now being constructed. There were also purchased during the year 70 electric motors and 50 improved steel trucks.

The following statistical statement, showing a comparison of the business and earnings of the company since its purchase of the franchise in 1892, was presented:

Gross earnings—1892, $820,098.49; 1893, $900,232.59; 1894, $958,370.74; 1895, $992,800.88; 1896, $997,273.20; 1897, $1,077,611.53; 1898, $1,210,618.24.

Operating expenses—1892, $590,333.26; 1893, $637,579.15; 1894, $517,707.53; 1895, $489,914.76; 1896, $507,760.31; 1897, $525,801.25; 1898, $578,857.26.

Net earnings—1892, $229,765.23; 1893, $362,635.44; 1894, $440,663.21; 1895, $502,886.01; 1896, $489,512.97; 1897, $551,811.28; 1898, $631,700.98.

Percentage of operating expenses to earnings in 1892, 71.9; 1893, 59.07; 1894, 54; 1895, 49.3; 1896, 50.9; 1897, 48.8; 1898, 47.4.

Transfers—1892, 5,592,708; 1893, 8,477,147; 1894, 7,438,171; 1895, 7,257,572; 1896, 7,354,895; 1897, 8,199,022; 1898, 9,287,239.

Passengers carried—1892, 19,122,022; 1893, 21,215,010; 1894, 22,609,338; 1895, 23,353,228; 1896, 23,537,911; 1897, 25,271,314; 1898, 28,710,338.

OTTAWA ELECTRIC RAILWAY COMPANY.

At the annual meeting of the Ottawa Electric Railway Company, held recently, the annual report submitted showed the gross earnings for 1898 to be $231,802, an increase of $8,000 over the preceding year. During the year four quarterly dividends of two per cent. each were paid. Six open and six closed cars were added to the rolling stock of the company. The report mentions that the outlook for a large development of both passenger and freight traffic is very promising. The number of passengers carried was 5,200,000, while five years ago the number was only 2,394,000.

The following board of directors was elected: T. Ahearn, president and manager; J. W. McRae, vice-president; Warren Y. Soper, G. P. Brophy, Thos. Workman, Alex. Lumsden, M.P.P., and Peter Whelan.

HAMILTON, GRIMSBY AND BEAMSVILLE ELECTRIC RAILWAY COMPANY.

At the annual meeting of the Hamilton, Grimsby and Beamsville Electric Railway Company, held in Hamilton a fortnight ago, the president, Mr. C. J. Myles, presided. The annual statement presented by Mr. Nelles, manager and secretary, showed the receipts during the year to have been $42,736.42, an increase of $735 over 1897. The net earnings were $13,981.11. The passenger business during the year amounted to $34,060.15; freight, $5,521.66, and express, $1,618.13. President Myles estimated that the company lost about $1,000 owing to the big snowstorm in December. A dividend of 5 per cent. was declared. The directors were re-elected as follows: Messrs. C. J. Myles, president; W. J. Harris, vice-president; R. S. Martin, treasurer; L. Bauer, R. Ramsay, A. H. Myles, J. Gage. Mr. A. J. Nelles was reappointed treasurer and manager.

Christmas Car—The Brownies.

SPARKS.

Mr. B. B. Osler, Q.C., has been elected president and Mr. Mark Thomas manager of the Hamilton and Dundas Railway.

The Hamilton Street Railway Company have elected Mr. Edward Martin, Q.C., as president, and Mr. John A. Bruce as vice-president.

A bill respecting the inspection of steam boilers and providing for the security of the lives of those working around steam engines has received a second reading in the British Columbia Legislature.

The directors of the Hamilton, Grimsby and Beamsville Railway Company have been asked by the residents of Vineland to extend their road to that place, five miles distant from Beamsville.

The Niagara Falls, Wesley Park and Clifton Tramway Company have made a proposition to the village councils to convert the horse car line between Niagara Falls and Niagara Falls South into an electric system.

Several Canadian street railway magnates, including Mr. James Ross and Mr. R. B. Angus, have been on a tour of inspection in the United States, with a view of obtaining pointers looking to the improvement of the street railway systems in Canada.

The Montreal Street Railway Company have decided to concentrate the whole of their constructive work at the Hochelaga shops. In the spring the company will build a large brass foundry for the manufacture of brasses and a large iron foundry for the iron work required in connection with their vehicles, an important part of this being the car wheels, which they intend to manufacture for themselves in future.

A new agreement has been entered into between the town council of Toronto Junction and the Toronto Suburban Electric Railway Company. One privilege granted the company is the extension of the franchise for 23 years from September 1st last. The company agrees to extend its lines to Cooksville or Woodbridge in two years, and to reach both places before the expiration of the present franchise.

A statement has been compiled showing the yearly earnings of the street railways in Montreal and Toronto for the years 1897 and 1898. In 1897 the Montreal street railway earned $1,397,363 and in 1897 $1,526,457. The respective earnings of the Toronto street railway were $1,048,273 and $1,187,622.

The C.P.R. Company several years ago discontinued running steam cars between Aylmer and Hull, Que., and gave over the road to the Hull-Aylmer Railway Company. Within the past month this latter company have purchased the road, paying therefor a sum in the neighborhood of $100,000.

The Galt, Preston and Hespeler Street Railway Company held its seventh annual meeting on January 31st. The business of the year was ahead of the previous one in both freight and passenger departments. Officers were elected as follows: Hugh McCulloch, president; Martin Todd, vice-president; W. H. Lutz, secretary-treasurer.

For the last three months of 1898 the gross earnings of the Quebec, Montmorency & Charlevoix Railway Company's system were over $79,000 and the operating expenses less than $34,000. After deducting one-fourth of the cost of removing snow in the winter, which is estimated at $12,000, the net revenue for the three months was over $42,000.

At the annual meeting of the Hamilton Radial Electric Railway Company held a few days ago, the reports presented were eminently satisfactory. The old board of directors was re-elected as follows: A. Turner, president; W. A. Wood, vice-president; John, Moodie, sr., treasurer; Stuart E. Malloch, secretary; James Dixon, Adam Zimmerman, John Moodie, jr.

The annual meeting of the London Street Railway Company was held on January 12th. The gross earnings for the year were stated to be $12,000 more than in 1897. The number of passengers carried was 2,841,568, and the number of miles travelled 1,074,302. The total gross earnings were $113,811.73. Mr. H. A. Everett was re-elected president, and Mr. T. H. Smallman was chosen vice-president in the place of Mr. E. W. Moore. Mr. Carr retains his position as manager.

At the request of the promoters of the proposed electric railway from Thamsville to Rondeau, an estimate of the cost of construction has been made by Mr. G. S. Johnson, general manager of the Consolidated Street Railway Company, of Grand Rapids, Mich. The length of the proposed road is 25 miles, and Mr. Johnson places its total cost at $257,968. Of this the power house, generators, boilers, etc., represent $50,000, and the cars, wire, equipment, etc., $125,000. To pay 5 per cent. on an outlay of $250,000 the road would have to earn $12,500 per year over running expenses.

CANADIAN HAND-BOOK OF STEAM AND ELECTRICITY.

TABLE OF CONTENTS—Continued.

INDEX OF ENGINEERS' MANUAL.

TRADE NOTES.

The Canadian General Electric Company have just received another order from the Montreal Ry. Co. for 12 of their standard G. E. 1000 railway motors.

The Stanstead Electric Light Co., of Stanstead, P.Q., have recently purchased a 2000 light single phase alternator from the Canadian General Electric Co.

Messrs. A. Gagnon & Co. of Arthabaskaville, have recently installed a new 2000 light single phase alternator of the Canadian General Electric Co's. new type.

The Canadian General Electric Company have closed a contract with A. S. & W. H. Masterman, of Montreal, for one of their new type multipolar 200 light generators.

The Ottawa Electric Co., Ottawa, have recently added to their arc lighting equipment one No. 12 125-light Brush arc dynamo, purchased from the Canadian General Electric Co.

The Department of Railways and Canals have placed an order with the Canadian General Electric Company for additional apparatus to be used at the Sault Ste. Marie canal.

The Hawthorn Woolen Mill Co., of Carleton Place, Ont., are increasing their lighting plant, and have placed their order with The Royal Electric Company for a 25 k.w. bi-polar generator, which is to be installed at once.

The Canadian General Electric Company are installing for H. A. Lozier & Co., Toronto Junction, one of their 200 light dynamos, with marble panel, and are wiring up some 200 incandescent lights in their new factory.

The Watson Mfg. Co., of Thorold, are removing to their new factories at Paris, and have placed an order with the Canadian General Electric Company for the wiring up of these factories, and installing a plant to furnish some two hundred and fifty 16 c. p. lamps.

The R. & O. Navigation Company have placed an order with the Canadian General Electric Company for one of their standard 30 kilowatt direct current generators, to be direct connected to an "Ideal" engine, as manufactured by the Goldie & McCulloch Co., of Galt.

The Canadian General Electric Company have recently installed for Messrs. Robertson, Rowland & Co.,of Walkerton, a 2000 light single phase alternator. This company have been operating a 60 kilowatt machine, of a similar type, for the past four years, and have met with great success in the their electrical undertaking.

Mr. N. P. Tanquay, of Weedon, P.Q., has contracted with the Canadian General Electric Company for one of their standard 55 kilowatt new type multipolar generetors and a 35 h.p. motor, together with marble panels and all line material and supplies required for carrying out the transmission of the above power.

The London Electric Company have placed an order with the Canadian General Electric Company for another No. 12 4-circuit 125-light Brush arc dynamo, and an additional 300 kilowatt revolving field single phase alternator. When these are installed, the above company will have one of the most complete lighting stations in Canada.

At the last meeting of Toronto No. 1, C.A.S.E it was resolved that the association deeply deplore the loss of life and personal injury to the innocent victims who suffered as the result of the recent boiler explosion at the icehouse in the east end of the city. And be it further resolved that we, as a body of engineers, wish to place ourselves upon record as concurring with the verdict of the Coroner's jury, which clearly set out the fact that the man in charge was incompetent ; and be it further resolved, that all steam boilers should be under the charge of practical engineers, who have certificates, and each boiler be inspected yearly by some competent person."

A peculiar accident occurred to a motorman of the Toronto street railway recently. He had charge of a Queen west car, and when approaching Spadina avenue the trolley wire broke, the loose end falling through the window of the vestibule and touching the motorman on the shoulders, thus making a connection with the ground. The motorman was thrown through the vestibule window onto the car track, but fortunately the car had stopped. His clothes were badly burned and his face and head cut, although the current had not affected his body.

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Member Canadian Society C.E.
Member American Institute E.E.
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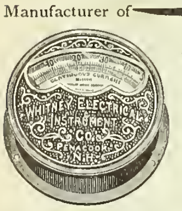

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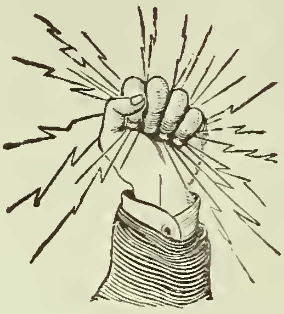

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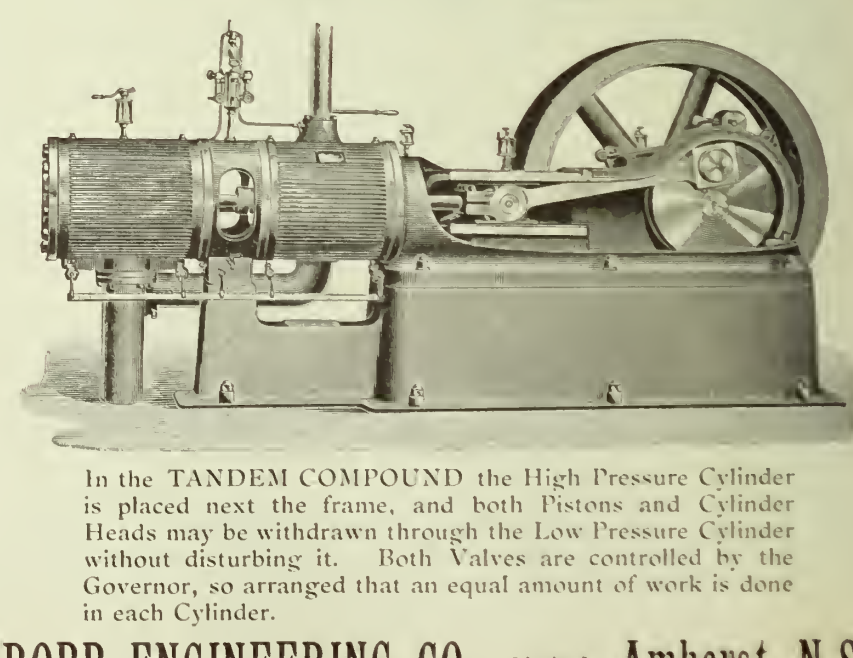

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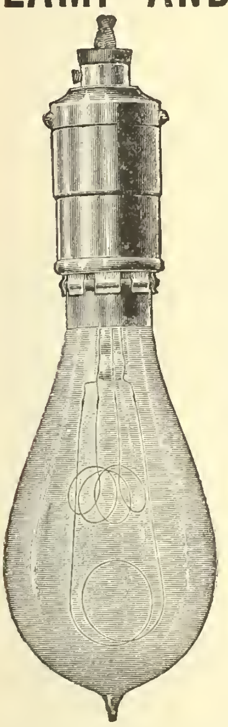

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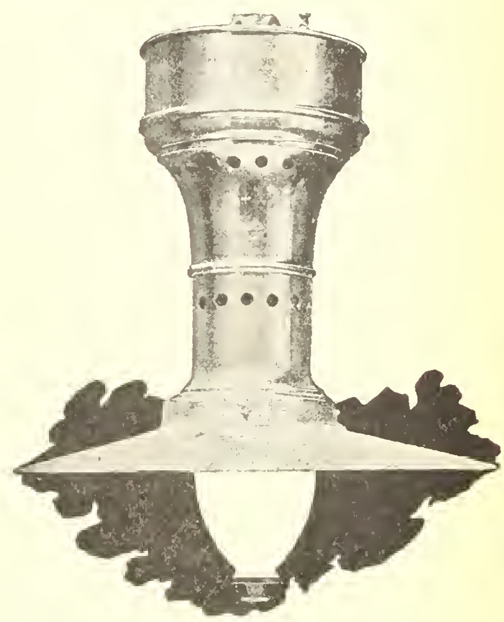

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CANADIAN
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VOL. IX. MARCH, 1899 No. 3.

THE ELECTRIC SIREN.

WHAT promises to be an instance of the practical adaptation of a long neglected possibility is the development of the principle of an electrically vibrated diaphragm, as found in apparatus recently elaborated in the hands of Mr. A. G. Trudeau, of Ottawa. The subject is one of such interest from an engineering point of view that some pains have been taken to obtain the information concerning it that is now here presented. The massive apparatus to be seen in Mr. Trudeau's workshops is the outcome of a long line of patient and persevering experimentation, and bears on the face of it having been given proper shape to fill the requirements.

Mr. Trudeau conceived at the outset that the vibratory alternate current of the electric light might be adapted for the purpose in place of the magneto ringer, and this conception led to the construction of instruments actuable in a commensurate way by any such extraordinarily heavy currents as might be had from such a source. Going further in the same direction, he supplied the sound products with current from a special alternating dynamo, the number of whose current pulsations per second can be altered at will by an increase or decrease of its speed, or otherwise, and thus achieved a

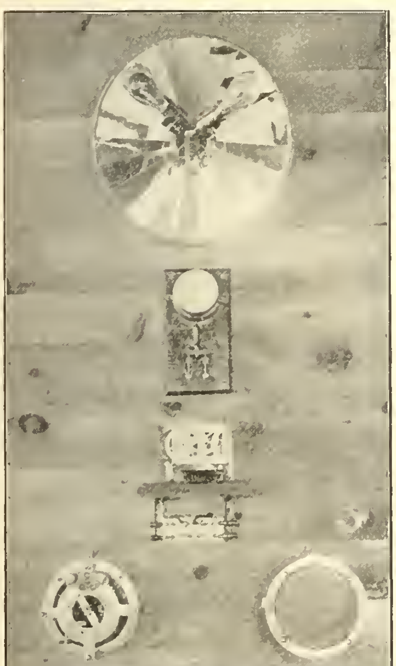

FIG. 1.—CLOCK MECHANISM AND SWITCHES, WITH GROUP OF INCANDESCENT LAMPS AND REFLECTOR.

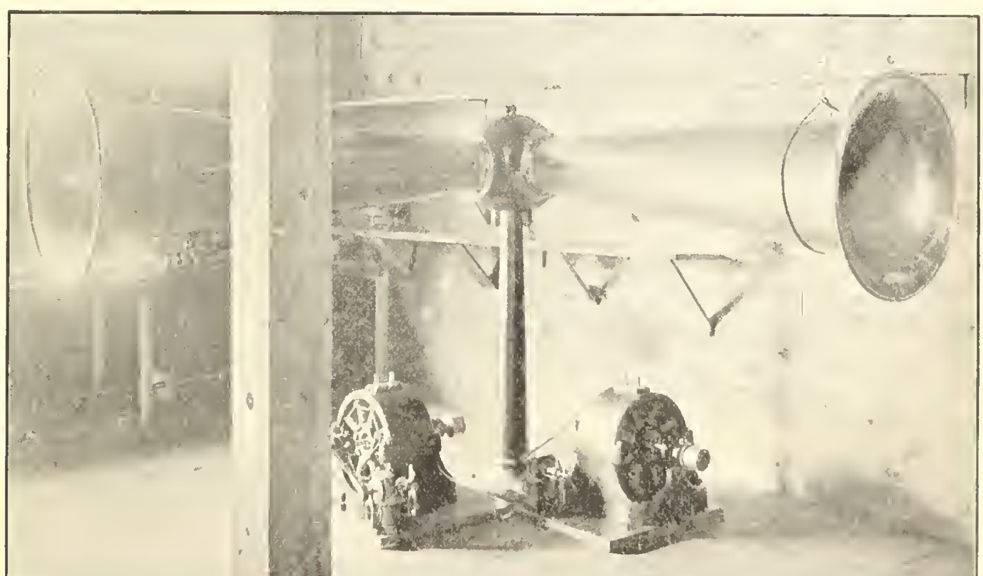

FIG. 2. ELECTRIC COAST SIREN.

and in its hugeness strong evidence of the inventor's confidence in the utility of what he had in view.

PRINCIPLE OF THE CONTRIVANCE.

Every user of the telephone is familiar with the behaviour of the 'phone if it happens to be "off the hook" and the distant ringer is put in motion. The diaphragm of the 'phone is subjected to a series of alternating current impulses, and manifests the effect of these by giving out a clattering noise not unlike the automatic electric buzzers sometimes used in place of the ordinary vibratory call bell. This observed behaviour of the 'phone under such conditions has been obviously enough suggestive of the construction of a call system comprising just such parts, but in practice the idea has not taken hold hitherto, perhaps because of the different elements going to make up the system not variable action in the sound producer, corresponding to the variation of note in a complex steam whistle or siren—whence the descriptive name for it with which this article is headed.

DETAILS OF CONSTRUCTION.

In furtherance of the foregoing comprehensive explanation of the character of the invention, the following details of the apparatus as now elaborated are given for the benefit of those of the readers of the ELECTRICAL NEWS interested in any new and unlooked for development of this kind. The outfit shown in the accompanying illustrations comprises what is needful for a lighthouse, with electric light and siren combined. In Fig. 1 a group of three powerful incandescent lamps, with reflector, is shown above the clock-work and switches. The number of these lamps is obviously referable to the

volume of current supplied, and may be replaced by an arc for the operation of a search-light if desired. Immediately beneath is shown an automatic time-switch, by which the lights and the siren (the latter shown in Fig. 2) may be operated alternately or simultaneously at given periods as arranged for. The clock-work may be an eight-day movement, requiring winding but once a week, and therewith the lights and siren might be operated automatically between, say, 5 p.m. and 8 a.m. daily, or at any other hours as predetermined. This clock-work, by which the signalling devices are operated, has two baths of mercury and two contact makers that dip into them and so close the respective circuits. As now arranged in the workshop, the siren is sounded for 20 seconds, and then the light is turned on for the remaining 40 seconds of each minute; the contact wheel makes but one revolution per minute, and so renders the wear and tear inappreciable and the movement durable and reliable. A rotating brush commutator might, of course, be used instead of this mercury contact but that the make and break spark would in time eat away the commutator segments and prove troublesome.

Beneath the lamps and switches there are shown front and back views of the vibrator or sound producer. It is very substantially constructed, having a steel frame, which is first coppered and then nickel plated so as to avoid rust and corrosion. The diaphragm is said to be of a specially prepared material and of magnetizable character, a suggested modification being one of bell metal or other non-magnetic material provided with small projections of iron to serve as armatures for the actuating electro-magnets, and it is secured in the frame by an annular clamp, somewhat after the fashion of a drum head. A screw device by which the amplitude of the vibrations of this diaphragm or drum head is to a certain extent regulated, is mounted opposite the centre in a cross piece at the back. A group of electro-magnets, made up of laminated iron cores wound in the ordinary way, is fixed in the frame and hidden by the broad and smaller annular ring shown in the left-hand (back) view, and thoroughly covered with insulating compound, and covered with rubber to shut out all moisture.

In Fig. 2 is shown the fog-horn proper, in one of the many forms that is being given to the device, and to be designated the "coast siren." It comprises two huge funnels made of ¼ inch copper and finished at each end in brass. Each of the funnels project 6 feet 6 inches from the stand, at right angles to each other. In each of these funnels or horns a vibrator or sound producer is placed, the object being to use them alternately or simultaneously as may be desired. The stand is of cast-iron and of very substantial form, 6 feet high, surmounted by a large hollow cast iron sphere, from which the horns project. This sphere is divided into two, the back portion opening on a strong hinge, enabling the light keeper to clean the instruments or make any necessary adjustments or repairs. The vibrator is self-contained and may be taken out and replaced by another in a moment, so there need be no time lost in event of a vibrator becoming broken or otherwise disordered.

Below the siren the source of the operating and lighting current is shown. This part of the plant comprises two alternating current dynamos with separate and interchangeable field exciters. Only one of these alternators is to be used at a time, however, the second being provided as a precaution against an accidental break-down. They have a capacity of 3½ h.p., are of the multipolar type, and were specially designed by Mr. Trudeau for the purpose, and they occupy each a floor space of 18 inches square and are 18 inches high. The field exciters were also specially designed, and occupy a floor space of but 6 x 8 inches, and are 8 inches high. All the work done on the different parts of the outfit is of the highest order and everything in its make-up has been designed and manufactured by Mr. Trudeau or under his immediate supervision in his shop.

The engines to be associated with the electrical plant are not shown in the illustrations. It is proposed to use a Gasoline type that can be set to work in one or two minutes. The power required to operate the siren and the light alternately is put down as 1 h.p. and is estimated to cost 15 cents; or, in cases where the maximum capacity of the plant (3½ horse power) is to be utilized —as for instance when a search-light is used—3½ x 15 = about 50 cents for a ten hours' run.

The complete installation, including the spare set of apparatus and dual engines, may be placed in a light-house room less than 8 feet square, and there being no cumbersome boilers, air compressors, etc., understood to be indispensable to other systems for a like purpose, the whole is calculated to be placed in position at a comparatively trifling cost.

OTHER APPLICATIONS.

Obviously, the apparatus in the form described in the foregoing has been designed to demonstrate the practicability of operating fog-alarms in places ordinarily inaccessible for steam plants, and where bell-buoys and hydraulic whistling-buoys are inadequate because of their comparatively feeble sounds being drowned in the noise of waters on neighboring shoals and wave-beaten head-lands. For the development of his invention, with this important object in view, too much credit cannot be given Mr. Trudeau, and it is to be hoped his undertaking will meet with a well-merited success.

Since it is immaterial how far the source of the actuating current is from the signalling instrument, or whereabouts in the circuit the controlling devices are located, the whole contrivance affords an ideal flexibility that can be approached by no other known means that has been devised for marine signalling purposes, and its adaptation to harbor-buoys connected by cable is only a matter of detail.

The minor applications for the device in its smaller forms, whether in combination with electric lighting currents or independent sources of current, are manifold and various—fire and burglar alarms for instance, or hotel and railway station gongs, police and cab calls, etc., all too patent to call for more than passing mention. Upon the whole, this interesting development of a neglected feature of every-day electrical operation seems well worth the extended notice that has herein to it been accorded.

D. H. KEELEY, M.I.E.E.

OTTAWA, 8th March, 1899.

At Tilbury, Ont., there is a municipal electric plant, which is in charge of Mr. J. H. Ward. We are advised that 400 lights are now wired up, while the capacity of the machines is only 500 lights. It is probable that the system will be changed to alternating, and a new 750-light machine installed. Some of the customers wanting lights are not within economical reach of the direct current system. One of the dynamos now doing service will likely be used for furnishing power for small motors, fans, etc., for which there is some demand.

THE LACHINE RAPIDS HYDRAULIC AND LAND COMPANY.

The annual meeting of the Lachine Rapids Hydraulic and Land Company, Limited, was held in Montreal on February 17th last. After the reading of the report explanations were made by the managing director as to the cause of the trouble during the past winter in connection with the lighting. He stated that it was owing to various causes, such as the extreme severity of the weather, which caused a block of ice below the tail-race—a phenomenon which had not occurred for forty-five years previously. He suggested remedies which he said would unquestionably overcome any such difficulties in future. It is understood that the tail-race dam will be extended and that other slight alterations will be made at the head race for the purpose of preventing interference from ice. Additional dynamos will likely be installed at once.

The report of the directors stated that, notwithstanding the difficulties incidental to the inauguration of all new enterprises, the business of the company during 1898 had been very satisfactory, and the general outlook for the future was bright.

The financial statement presented was as follows :

Gross earnings for the year ending December 31st, 1898		$118,121 23
Discounts allowed		19,824 53
Net earnings		98,296 70
Add interest on bank account and stock calls, and discounts on cash purchases		3,991 12
Gross revenue for the year		102,287 82
Operating expenses, including general expense, lamp renewals, commissions, pole rent, placing meters, testing meters, painting poles	$45,098 33	
Rent, insurance and taxes	3,897 73	49,996 06
Leaving a gross profit of		$52,291 76
From which has been charged for interest on bonds.		19,530 47
Leaving a net profit of		$32,761 29

equivalent to almost 3 p. c. on the paid up capital.

From the report the following particulars are obtained : During the year additions to the plant were made which cost $206,866. The company have constructed in Montreal and vicinity 175 miles of wire, and have also placed 4,700 cross arms. This work consists of three phase lines for power and light on the principal streets of Montreal, and a large number of single phase circuits in localities where lighting only is used. An arc system was constructed for the C.P.R. at Outremont, and a permanent switch-board at the power house.

The total number of incandescent lamps on the company's circuit is 40,135. Of the above 35,335 incandescent lamps or their equivalent are on meter, and 4,800 on flat rate. This is exclusive of lights furnished by the Imperial Electric Company, who receive the necessary current from the Lachine Company. The total number of alternating arc lamps not on meter is 309. The company have 36 motors installed, with a total capacity of 924 h.p. Last year there were added over 15,000 incandescent lamps, while the number of arc lights increased from 54 to 109. The increase in flat rate customers for incandescent lighting was from 227 to 343, and their power service increased from nothing to 924 h.p. .

Attention is drawn to the fact that the principal profit from the plant already installed is derived chiefly from the output of a few hours' lighting out of the twenty-four, that although lamps are connected and current is on, the customers only use the power during a short space of time, while the operating expenses of the company remain the same as though their power were being used and paid for during the whole period. They could afford to dispose of power at a very low rate if customers could be found who would be prepared to use it at other times than the hours above referred to.

The directors point out with much satisfaction that the company has been able during its first year of operation to pay not only the interest on its bonds, but all its operating expenses, and earn the handsome profits of nearly $33,000.

NERNST'S ELECTRIC LIGHT.

Prof. Walter Nernst, of the University of Gottingen, Germany, is the inventor of a new method of lighting by electricity, which is briefly described in the following abstract from a paper read by Mr. James Swinborne before the Society of Arts, London, England, on February 8th last :

Nernst's, like most great inventions, is exceedingly simple as soon as it is understood. The efficiency of an incandescent body, as far as radiation goes, depends simply on the temperature. The efficiency of an incandescent lamp, for instance, depends on the temperature of the filament only, providing there is no loss by convection. The carbon will not stand a sufficiently high temperature, especially as, in addition to its low specific resistance, the filament has to be long and slender, and thus weak. Nernst, therefore, chose a material that would stand higher temperatures than carbon, and his material has the incidental advantage that its specific resistance is so high that strong rods can be used for high pressures instead of thin filaments. The most refractory materials so far used in lighting are zirconia, which has been used to replace lime in the limelight, and the oxides or so-called rare earths in the Welsbach mantles. I am aware, of course, that many people suppose that the Welsbach mantle is not very hot, treating it as if it were at a temperature, for instance, below the melting point of platinum. The light emitted is supposed to be due to some special power of selective emission due to the oxides employed. I have had a good deal to do with incandescent gas mantles, and I find no reason to suppose there is any magic effect of this sort going on. The part of the flame where the mantles hang fuses platinum wire easily, and very few materials can stand the temperature without fusing or volatilizing. Lime and many other oxides volatilize slowly from the mantles. I do not mean that the mantles are above the boiling point of lime ; I have some idea of its melting point, as I have made a few pounds of melted lime, and run it out on the floor to look at it. The Welsbach mantles, which are now chiefly thoria, are at a temperature near their softening point, and in the making are raised to a temperature at which they begin to soften.

Nernst takes highly refractory oxides as his material. It does not seem promising, because such oxides are notoriously good insulators. But such insulators are electrolytes when hot ; Nernst, therefore, heats the rods to make them conduct, and then heats them electrically, preserving a temperature which is within the limits that the material can bear without softening. This means that he can take the most refractory bodies supplied by the whole range of chemical research, and can heat them to a temperature short of their softening point, and can thus get an efficiency unknown to workers on the incandescent lamp. Such efficiency also means whiteness of light, so long as the efficiency is not too high. Thus the crater of the arc being at a temperature of boiling carbon, gives a light that is unpleasantly blue. The material is worked up into little white rods. Each rod is mounted on two platinum wires, a little paste made of refractory oxides being applied to the joints. The little rod, with its two wires, is then mounted in a holder which fits ordinary electric light fittings. As the rods fall in resistance as the temperature increases, after the manner of electrolytes, an increase of current produces a decrease of resistance. This tends to give some instability in running in parallel on supply circuits. This instability is corrected, as in an arc lamp which has analogous properties due to a different cause, by a series resistance. The Nernst rod has therefore a resistance in series. This is made up of exceedingly fine wire, and for ordinary circuits amounts to 10 or 12 per cent. of the whole resistance of the lamp. The consumption, including the resistance, is 1.5 watts per candle for large lamps, and 1.6 for small lights or low pressures. In small or low pressure lamps the loss of heat at the ends is larger in proportion.

In all probability an electric light plant will be installed in the new city hall in Toronto, for the purpose of lighting the building.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

The Overcrowding of Street Cars.

THE bill which was recently introduced in the Ontario Legislature by Mr. Crawford, M.P.P., to regulate the overcrowding of street cars is, to our mind, one of the most unreasonable measures which has yet been compiled. Applying only to cities with a population exceeding one hundred thousand, it is applicable exclusively to Toronto. Clause one provides that every passenger on a street car shall be entitled to a seat, while the third clause states that no person shall be refused the right to admission in any car provided there is reasonable standing room for such passenger. A passenger unable to secure a seat is to demand and receive from the conductor a ticket entitling him to a seat in any car on the same route during the same hours of any other day, or at his option he may tear his ticket into two parts and use one part for that trip, the other part to be good for a standing trip at any future time when the cars shall be so overcrowded that he shall be unable to obtain a seat. Such a law would be unworkable, and unfair to the companies operating street railways, who are given no protection from unscrupulous persons, who would seize every opportunity of boarding a car whose seating accommodation was already exhausted, notwithstanding that other cars in which seats could be had might be available. In large cities, upon the occasion of the holding of exhibitions, public meetings, and other events to which the public are attracted, the people gather in such numbers that no reasonable street car service could provide the necessary accommodation to the satisfaction of all. Another illustration will show the absurdity of the bill. A passenger might board a car the seats of which were occupied, pay his half fare to the conductor, and at the next stopping point—perhaps not two hundred yards distant—one of the passengers might alight, thus giving him a seat for almost his entire journey. In these instances, Mr. Crawford's bill, if passed by the Legislature, would be the cause of a serious injustice to the railway companies.

The Nernst Method of Electric Lighting.

THE information to hand respecting the new departure in incandescent lighting (Nernst's invention) is scarcely complete enough to warrant a definite opinion. It looks as though it would create a new departure in incandescent lighting on similar lines to the Welsbach improvement in gas business. The Welsbach was considered one of the greatest advances in gas illumination ever brought forward. Experience of its continued use, however, has not quite justified the sanguine expectations of its promoters. The Nernst lamp may be a new departure that may practically revolutionize electric lighting, or it may develop defects and unforeseen drawbacks that may keep it from becoming a serious competitor with the present system of vacuum lamps. An automatic arrangement to heat the rod must be, to a certain extent, complicated and liable to get out of order and unsuitable for small lamps. It may be that for store lighting, such places as factories, railroad stations and so on, the system would be eminently suitable, while for high class lighting, such as for residence purposes and decorative effects, the vacuum lamp would lend itself with much greater adaptability. The cost of this lighting is not so excessive at the present time that convenience and appearance may be sacrificed for the sake of extreme economy. At present something must be allowed for the enthusiastic optimism with which a new departure like this is apt to be received, but notwithstanding, later developments may show that a distinct advance has been made in the commercial adaptability of the electric light.

Municipalities and Lighting Companies.

THE treatment accorded to electric lighting companies in Germany appears to closely correspond to that which Canadian private lighting companies in many instances receive at the hands of the municipal councils. The City Council of Berlin proposed to give a contract to the electrical companies for the supply of electricity for a period of fifteen years, provision being made that the municipality should participate in the profits. Strong pressure was brought to bear by the social democrats to compel the Council to assume entire control of the electric lighting. This demand would probably have been acceded to but for the fact that the authorities feared that new discoveries might take place in the near future which would depreciate the value of the existing works. In view of this, it was finally deemed advisable to approve the contract with the electric companies. The policy of many municipalities in Canada, as in Germany, is to saddle the private lighting companies with all the responsibility and expense incident to placing the electric lighting business on an established basis, and when that point shall have been reached, step in and assume control without even offering to buy out the existing works at a fair valuation. This has the appearance of base ingratitude and injustice to the enterprising men who were the pioneers in electric lighting, and who in many instances were induced to embark their means in an untried and doubtful enterprise by the promises of support made to them by the municipalities. It is to be hoped that the Provincial Government wil

step in and see justice done—that millions of dollars' worth of valuable property shall not be rendered valueless, but that where it is the desire of the municipality to own and operate an electric lighting plant, it must, as in the case of water companies, purchase at a fair valuation, to be fixed by arbitration, the works of the existing private lighting company.

Relations of Lighting Companies to Municipalities.

A BILL has been introduced in the Ontario Legislature by Mr. Conmee to amend the Municipal Act in respect to municipal lighting. The object of this bill is two-fold. 1. To place gas and electric light companies, in cases where a municipality desires to go into the manufacture of gas or electric light, in the same position as water companies now are where the municipality desires to go into water supply. The present law regarding water companies provides that before the council shall levy any water rate, they shall make an offer for the works or stock of an existing water company, and the water company then can either accept the offer, or may give notice of an arbitration to determine the price to be paid by the municipality for the works. 2. The second proposal in the bill is, to enable municipalities to secure street lighting and lighting for public uses from an existing light company, on fair terms. At present the Municipal Act permits a contract by mutual agreement to be made between a municipality and a company for street lighting and lighting for public uses for a term not exceeding ten years, but a municipality, as the law now stands, has not power to require a company, against its consent, to supply such lighting upon what it may consider to be fair terms. It is therefore proposed by this bill to permit a municipality to make an offer to a lighting company of terms of contract for such lighting, and in the event of the company refusing the offer of the municipality, the municipality will have power to secure an arbitration to determine the price and terms of the contract.

It will be observed that the first of these provisions will not prevent municipalities entering upon the supply of light. It simply provides that if they do enter upon such undertaking, they are first to try to buy, at a fair price, or at a price to be fixed by arbitration, existing works. No valid reason can be advanced why the law, now applicable in case of water-works, should not be extended to light companies as well. Such a purchase will put the municipality in the possession of the very plant and material which they would have to purchase from other sources, if they are going into the business. Gas and electric light companies, as well as water companies, have always come into existence with the consent, encouragement and approval of municipalities, who have granted the use of streets, and in many cases, exemption from taxation for these works. They have thereby induced enterprising citizens to embark their capital in these undertakings. It is unfair and unjust that municipalities themselves should afterwards have power to destroy the value of the very property they have encouraged citizens to purchase and pay for, when that property can be utilized by the municipalities themselves if they so desire. Such a law also benefits municipalities, because it tends to extinguish rivalry to themselves, which rivalry might render municipal operation of these works unprofitable. It is also in the public interest, because it will further encourage private citizens to invest their capital in new enterprises, and in extending and improving existing lighting works. At present, private capital is in danger of being lost through municipal competition, if invested in such works, or in extending and improving existing works, and all private enterprise in these directions is paralyzed and discouraged.

The equitable character of this bill was admitted last year by leading members of the Legislature on both sides of politics, including the Hon. Mr. Hardy and Mr. Whitney. The principle was long since recognized in Great Britain, where the law provides that the municipality cannot interfere with an electric light company until the expiration of twenty-one years, or such shorter period as is specified in the application by the company for the original order. At the end of twenty-one years the municipal authorities may, by notice in writing, require the electric light company to sell their undertaking upon certain terms adjusted by independent authority. If they do not so require, then the company goes on for seven years further ; at the end of that seven years the municipal authorities have again a right to purchase, and so on at the end of every term of seven years.

Municipal ownership in rivalry with an existing company is a case of a whole community going into competition with private individuals who are the shareholders of the existing gas and electric light company. These people are taxpayers, and a part of their money contributed to the municipality would be used in competition to themselves and to confiscate their own property. On economic grounds, it is evident that the purchase of the plant of an existing company would be more profitable both to the company and the municipality than the duplication of plants for competitive service. Duplicating plants involves a waste of capital. The second proposal in this bill, which is just and proper in itself, will remove a grievance which municipalities complain of under the present law—viz., that they have been charged with high rates for street lighting by existing companies, and have been unable to compel companies to furnish such lighting at reasonable rates. By the proposed amendment they will be enabled to secure street lighting either upon their own terms, if accepted by the company, or upon terms to be fixed by fair arbitration. While, on careful consideration, it may be thought desirable to make some slight amendments, the measure as it stands gives evidence of having been carefully framed so as to safeguard all the interests involved. It is therefore highly desirable that it should meet with the approval of the legislators on both sides of the House.

QUESTIONS AND ANSWERS.

"R," LINDSAY, Ont., asks : "When was electric light first used on the streets of Toronto ? When was incandescent light first used as an article of commerce in Ontario ? When was the telephone first used commercially in Ontario ?"

ANSWER.—Electric lights were first used on the streets of Toronto in the fall of 1883. Incandescent lights in series on arc circuits were used in several places in the province of Ontario the following year. The first telephone line in Ontario was built in the city of Hamilton in October, 1877.

TELEGRAPH and TELEPHONE

NEW TELEPHONE REPEATER.

INVENTORS have tried to devise means whereby telephonic messages might be repeated from one circuit into another in order to permit conversation over unusually long distances. Little success has hitherto been attained in this regard. All telephone repeaters, except that about to be described, have the diaphragm of a Bell receiver, or its equivalent, to vary the pressure on the carbon of a microphone transmitter at the end of the first circuit, and so cause a repetition of the message in this circuit. Nearly all repeaters can be used only in repeating messages from the first into the second circuit. None but the new repeater can repeat into an indefinite number of circuits in a manner similar to repeating into an indefinite number of telegraphic circuits.

Telephone repeaters have usually been unsuccessful, because although the amplitude of the diaphragm's vibration in the transmitter is considerable, yet that of the diaphragm in the receiver is very small. Hence, the variation in pressure on the carbon transmitter of a repeater is small, and consequently the telephonic message at the end of the second circuit is very weak, if indeed it can be heard even on short circuits.

In the new repeater a telephone receiver which can speak more loudly than a person is used. This motograph receiver was invented more than twenty years ago by Mr. Edison. It has a cylinder of plaster of Paris moistened with a solution. Pressed against the face of this cylinder is a strip of platinum, the other end of which is fastened to a diaphragm. One line wire is connected with the platinum, and the other with the cylinder. When this is steadily turned by hand or other motor, the strip is drawn forward by friction on the cylinder or released, according as a weaker or a stronger current of electricity passes through the film of chemical solution between the platinum and the cylinder. The platinum, being fastened to the diaphragm, imparts its motions to the same. The diaphragm throws the air into accoustic vibrations, reproducing the sender's voice. The sound of the receiver is dynamically caused by the motor which turns the cylinder. This is turned with more difficulty during the reception of a message than when the line is idle. The electric current which flows on the line merely controls the vibrations o the diaphragm. The motograph has been little used, because Bell's simpler receiver speaks in a sufficiently loud tone for common service.

It recently occurred to the inventor of the new telephone repeater that by using Edison's loud speaking receiver or motograph near the carbon or other suitable transmitter of a second circuit, a message spoken into the first circuit would be repeated with undiminished force into the second circuit. At the end of the second circuit a repeater may be used to forward the message into a third circuit, and so on throughout an indefinite number of circuits. At the end of the last circuit a Bell receiver may be used, if desirable, instead of the motograph. A small electric motor may be used for driving the cylinder of each repeater during business hours. By means of a duplication of transmitting and receiving parts in each repeater, messages may be automatically sent in either direction.

All parts of one or more continents could be brought within speaking distance of one another. The reproduction of a speaker's voice would be louder than the voice itself, because the sounds at each repeater are dynamically due to the motor which rotates the cylinder. The reproduction of the voice at the end of a dozen circuits would be as loud as that at the end of the first circuit.

The inventor has devised a practical telephonograph. At the end of the last circuit a phonograph may be set before a motograph receiver. This will speak as loudly as the person sending the message, hence this may be as deeply impressed on the wax cylinder as if the speaker were present. The phonogram may be detached from the phonograph and sent to the person addressed. He may at leisure place this on his phonograph and listen to the message. The phonogram may be saved, and caused to reproduce the voice of the correspondent at any future time.

JAMES ASHER.

Dunnville, Ont., Canada, March 3, 1899.

LAYING ATLANTIC CABLES.

MR. F. A. Hamilton, E.E., of Halifax, N. S., recently delivered before the Dartmouth Literary Society an interesting talk about the North Atlantic cables, with the laying of many of which he was personally associated. The many difficulties and disappointments which were met in endeavoring to connect the two hemispheres by cable were interestingly and sometimes thrillingly described.

In 1857 the first attempt was made by a United States ship. A start was made and 350 miles of cable payed out, but just when there seemed to be hope of success something caused the cable to part, the end was lost overboard and sank in a hundred fathoms of water, and the 350 miles was lost. In the next attempt two steamers started in mid-ocean one proceeding toward Ireland and the other toward Newfoundland. The end was again lost overboard and 290 miles more of cable were left on the bottom of the sea.

On July 28th, 1858, another attempt was made, this time with better success, for in August both ships arrived simultaneously at Newfoundland and Ireland, having accomplished the work of connecting Europe and America by cable. About 400 messages were transmitted by this cable, some of which were given by the speaker. One of the first was from the directors of the company in England, and occupied about twenty minutes in transmitting. It was, " Europe and America are at last united. Glory to God in the highest and on earth peace and good will toward men." The second message transmitted was from Queen Victoria to the President of the United States. On September 3rd, 1858, this cable had breathed its last, but the feasibility of the work had been demonstrated, and it was not long before it was again taken up.

In 1865 the next attempt was made, with cable of superior quality and with better steamers and appliances. The ships engaged in the work were the Terrible, Sphink and Great Eastern. After the start was made, as the cable was being payed out, the speaker described the intense anxiety on board for fear of losing the connection. When being passed from bow to stern the cable caught in something, and before the ship's way could be checked it had chafed and broken and sank to the bottom in 2,000 fathoms of water. Then commenced a series of drags, but all to no avail ; it could not be recovered, and the work was abandoned in 1865.

But the hopes of the men who had undertaken the work never wavered, and in 1866 they were realized. The Great Eastern accomplished the work and established the ties that have never since been severed. The bones of the Great Eastern, on which the speaker had served, had been since distributed among dealers in old iron.

From that time forward great strides had been made. In a short time over 1,600 tons of copper wire had been laid in the North Atlantic. In 1873 and 1874 great work was done, which was continued until nearly every place of any importance whatever has cable connection. In 1874 the Faraday had commenced the work she is still carrying on.

To-day repairing in deep water was no longer the difficult task that it had been. The automatic grapnel was a great aid in the work. As soon as the cable was hooked connection was established and those on board were aware that the cable had been picked up. The ringing of the bell was a welcome sound after long and tedious dragging.

A case of repairing in 1,500 fathoms was described, and the delicate work of raising the cable to the surface without breaking it was shown. It had to be picked up a couple of miles from the break, so that the end would not slip off the grapnel. Then the connection was made and the other end was picked up in like manner. To raise the bight from about two miles of water required about four miles of the cable, so that the two ends thus raised would be ten, twelve or fifteen miles apart. Breaks were accurately located by calculating from the resistance. The break described occurred 1,442 miles from St. Pierre.

SHORT-CIRCUITS.

Mr. Chas. Hosmer, manager of C. P. R. Telegraphs, has returned from the European continent, his daughter in Paris having recovered from her recent illness.

Mr. R. G. Holland, of the Mica Manufacturing Company, of Ottawa, reports that the mining business in the Lake Gerard district, near Wakefield, is brisk this season. The company intend carrying on extensive operations, and will employ upwards of one hundred hands.

The announcement has been made by the Financial Secretary of the Treasury, Mr. R. W. Hanbury, in the British House of Commons, that the government has decided to introduce competition in the telephone service in the country. He asked for a credit of $10,000,000 as a starter in order to enable the Post-office Department to develop the telephonic communication of London.

Mr. Frank Richardson, assistant electrician of the C.P.R., with a staff of assistants, is about to leave Ottawa for the Pacific coast. Acting under instructions from the Minister of Public Works, he will construct a telegraph line from Skaguay to Dawson. The distance is 600 miles, and the cost (on the basis of $250 per mile) will be $150,000. It is expected that the line will be in operation by the 15th of November, 1899.

The annual meeting of the Bell Telephone Company was held in Montreal last month. The directors' report stated : 1,637 subscribers have been added during the year, the total number of sets of instruments now earning rental being 32.082. The company now owns and operates 343 exchanges and 340 agencies. 666 miles of wire have been added to the long distance system in 1898 : of these 326 miles are in the Ontario Department and 340 miles are in the Eastern Department. The long distance lines now owned and operated by the company comprise 17,233 miles of wire on 6,006 miles of poles. The receipts for the year 1898 were $1,302,004.04, made up as follows : Exchanges, $935,703.52 ; long distance lines, $264.455.40 ; private lines, $12,743.32 ; miscellaneous, $90,041.71. The expenses were $971.792.30, divided as below : Operating, $807,138.73 ; legal, $9,-582.22 ; insurance, $13,740.20 ; bond interest, $47,042.16 ; miscellaneous, $4,288,99. This left a net revenue of $331,151.74.

MODERN SYSTEMS OF INTERIOR WIRING.*

By L. B. Chubbuck.

When the incandescent electric light was introduced commercially about 1881, in order to supplant its rival gas, it was claimed that the new illuminant required merely the cheapest and simplest kind of wiring. Paraffin covered wire (i.e., copper insulated with two cotton layers soaked in paraffin) had been used before this time for electric bell and telegraph work, and was at once adopted for electric light wiring. This covering was found to be totally useless, however, as often an overheated wire would ignite the inflammable covering, the flame following the wire for long stretches, especially where concealed under the floors or between the walls.

When the underwriters discovered this, they demanded a covering that was non-inflammable. So-called "Underwriters" wire was then introduced, the covering of which consisted of a cotton fibre braid, with a coating of zinc paint on the outside. This wire, while being non-combustible, was not water proof, and where moisture was present, electrolysis was set up, which soon destroyed the wire.

After the short stay of the "Underwriters" wire, a wire insulated with bitumen was brought forward to be used in moist

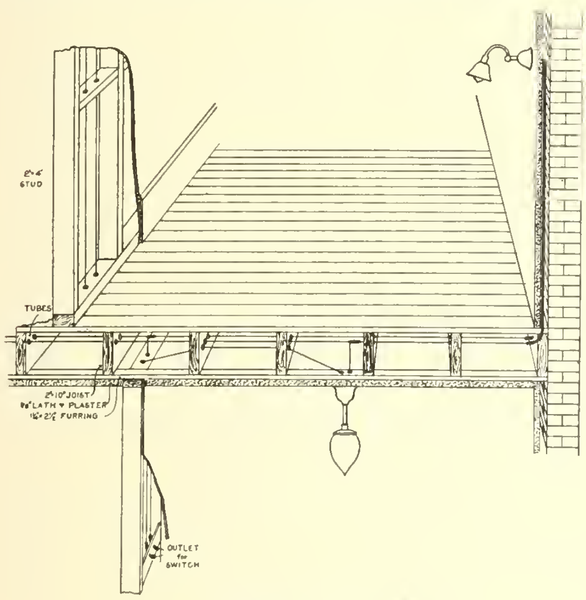


Fig. 1.—Porcelain Tube Work.

places. This, under the name of "Paragon wire," gave good results for a time, but eventually its insulation was found to crack, and its manufacture was discontinued. Since then various grades of composite and rubber covered wires have been introduced which are water-proof and of high insulation. These have survived to date.

A little of the earliest work was done by tacking the wires in place with small metal staples. This soon proved so objectionable, especially with poor grade of insulation then used, on account of grounds, short-circuits, etc., that it has been condemned ever since. A great deal of wiring after this was done with wooden cleats to support the wires in position. The wires were carefully run in respect to being kept away from gas or water pipes, and though no attempt was made to keep them from touching wood or plaster, they have given good satisfaction in nearly all cases where the buildings were perfectly dry. But natural dampness in the atmosphere, a leaky roof or the accidental spilling of water, is most liable to impair the insulation to such an extent that considerable leakage might take place. Fortunately, in this climate the small amount of moisture in the atmosphere has practically no effect on inside wiring, though in foggy districts near the sea coast, and especially in England, a great deal of trouble is experienced from grounds caused by a film of moisture forming over the surface of the fittings. In regard to wires imbedded in plaster, the effect on the insulation is uncertain, depending on the composition of the plaster and the covering on the wire. In some cases the alkalies in the plaster soon break down all insulation on the wire, while there are many nstances of specimens of wire testing well after being imbedded n plaster for many years.

To prevent any liability of leakage or chemical action on the wire, it is now supported throughout on porcelain knobs or cleats, and where passing through timber or plaster is surrounded by a porcelain tube. In Fig. 1 is shown a sketch of this method of wiring as installed in the ordinary style of building. As may be seen from the figure, there is considerable open space in the partition walls, under the floors, and in many cases on the outer brick walls, in which the wiring may be concealed. The joists, studding, etc., are bored to receive the porcelain tubes, and the wires run through these tubes, which are made in different sizes and lengths, depending on the size of the wire and the thickness of the timber they are to pass through. The wiring of such a building is most readily done while the building is under construction and before the lathing and plastering is commenced. In finished buildings, where the wiring is to be concealed, the problem is more complicated, and to avoid breaking the plaster, a number of devices are used by different contractors. In passing down the partition walls the best work is done by using bits with shanks that can be lengthened to twelve feet or more, and boring through all obstructions in the partition from top to bottom. In passing down the narrow space between the lathing and brick work on outer walls, what is technically termed a "mouse" is used, consisting of a short chain fastened to the end of a cord. This is dropped down the wall and fished out from below ; the wires are then drawn up to the outlet in flexible conduit. In order to conceal the wiring under the floors, some of the flooring is taken up, preferably by carpenters, although in small jobs this work is generally done by the electrican himself. Where thick gummy flooring is encountered, this is a most laborious operation with a hand saw, and a small circular saw is often used to much advantage. The writer has seen a combination of one of these saws geared to a small iron clad motor used for this work, which answered the purpose perfectly. Both saw and motor were mounted on a light wooden frame, by which the saw was moved ahead as the cutting proceeded. The connection to the motor was made by a long twin wire to the mains in the basement.

When it is considered too troublesome or expensive to conceal the wiring in a finished building by lifting floors, etc., the wires are often run in wooden moulding to diminish the unsightliness of open wires across the ceilings or walls. This class of work is much used on steam boats and is especially adapted in wiring panelled rooms, as the moulding may be made to match the woodwork of the room. Considered from an electrical rather than the decorative standpoint, wiring imbedded in moulding is inferior to wiring supported on porcelain and freely surrounded by air. The dissapation of heat is much easier effected in the latter case than in the former, and in a damp place the moulding will cause leakage, as wet wood is a conductor rather than an insulator. A case was met with recently where a No. 8 wire under the action of electrolysis had been entirely wasted away to a green trace of copper salts, by being imbedded in

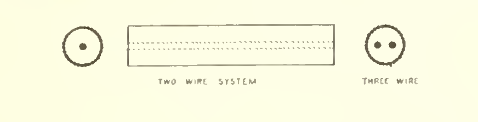


Fig. 2.—Concentric Work.

moulding, which had been soaked by a break in an adjoining water pipe. In practice the use of moulding is confined to work which is in full view and quite dry, and is not allowed in concealed work, such as between floors and ceilings, because of uncertainty as to dampness.

A method of wiring especially adapted to fireproof buildings, and known as the concentric system, is used to a great extent in England and Germany, though not yet in America. In this system, as illustrated in Fig. 2, instead of using two separate wires, one conductor is enclosed inside of an outer armor, which is

* Paper read before the Engineering Society of the School of Practical Science, Toronto, and published by permission.

used as the other conductor. The inner conductor is a tinned copper wire, which is surrounded with vulcanized rubber, taped and bedded with jute. Over all is bound a layer of galvanized iron wires twisted spirally, forming a complete tube about the inner conductor, and having a conductivity equal to it. For three-wire work, there are two inner conductors, insulated from each other, and from the outer covering, which in this case is used as the middle wire of the system. In both the two and three wire work this outer armor is grounded where the mains enter the building, and at different points along the wiring, if the stretches are long. A case may occur where the terminals of two separate concentrics which are on long circuits come a short distance apart. If one of these cables is fully loaded while the other is idle, there may be a "drop" of 2% on the loaded cable to no "drop" at all on the other, which will cause a difference of potential of 1% between the outers at the ends of the two cables. This under certain conditions is sufficient to set up electrolysis, which in time would destroy the covering of one or both cables unless they are both well grounded at these ends. For alternating current work, unless for short runs, both conductors must be run in the outer covering, as in the case of a single conductor in an outer iron armor, the drop along the line will be increased by impedence due to the alternating current.

The advantages of the concentric system are, that there is practically only one wire to run, and this may be buried in plaster or run over iron work with impunity. The cable itself also is quite small, being for a No. 12 wire only $\frac{5}{16}$ in. in diameter, and as no insulators are required it is very easily concealed. Since it is armored, it is unaffected by nails, etc., and in case of any rough usage, such as the rupture of the cable by a chisel, a dead short-circuit is formed, which blows the fuse immediately, without any arc being formed external to the cable. The adherents of this system claim, like Mark Twain, that it is best to put all your eggs in one basket and then "watch that basket." They argue that it is better to put all the insulation on one conductor, and to see that this insulation is well protected, than to have two conductors, each liable to a breakdown. The disadvantages of this system are, first, the obvious difficulty in making the joints, and, second, having the outer grounded, which is a disputed question. This system is used chiefly in isolated plants or in buildings using alternating current and supplied from separate tramsformers, as there would probably be considerable electrolysis of gas and water mains where there was a network of bare outer conductors all over a city.

Tho concentric system is not used in America, and in the modern type of fireproof buildings, having brick partitions and floors of brick arches across the steel floor beams, the frail system of wiring on porcelain knobs is unsuitable. There is usually no free space along the floors or in the walls for running the wires, and even if there were such a space, the chances are great that falling mortar or brick would either break the wires or ground them on the steel frame work. To provide protection and accessibility to the wiring in such buildings, the conduit systems have been evolved. As far back as 1885 there are instances of wiring on some steamers being run in small brass pipes. The inside of the pipes was smooth, and as the runs were not long, the flexible cord used was easily threaded through the pipe from one opening to the next. Speaking tubes were tried about this time to act as a channel for the wires, but it was found that the conductors could not be inserted or withdrawn freely, and speaking tubes for this purpose were discarded. Since that time there has been very largely used a tube of papier mache, impregnated with a bituminous compound, to render it impervious to moisture and also to increase its insulation. It was found, however, that when this "plain conduit" was concealed in plaster, it was ultimately destroyed by chemical action. Another form of conduit, called circular loom or flexible conduit, is now used extensively. The inner portion consists of a tube formed by a strip of treated paper wound in a spiral; over this is a braided covering coated on the outside with flakes of mica. Though the inner tube is rather inflammable, the outer tube will withstand quite a flame for some time.

The next step was to cover the plain papier mache tube with a thin brass sheath having a longitudinal seam. This brass armored conduit was thought at one time to be near perfection, but even it was found to have its faults. It withstands chemical action to some extent, but is not completely waterproof, and, like all the preceding forms of conduit, it is very susceptible to mechanical injury. Much of the trouble with brass armored conduit has been due to the poor manner in which it was installed, as moisture entering at the outlets or at poor joints is absorbed by the inner lining, which in time will ground the wires on the outer covering.

Several tests were made in the school laboratories on both the circular loom and brass armored conduit, to determine their insulation under the presence of moisture. These tests were made by the condenser method in connection with an electrostatic voltmeter. It was found that in the case of the circular loom, though of fairly high insulation when dry, the insulation resistance fell off very rapidly under the presence of much moisture. The brass armored conduit tested well when dry, and also with moisture for a short time. When exposed, however, to damp for some time, especially if the armor was defective, the insulation fell off, the effect of grounding being more noticeable in the case of the brass armored conduit than with the circular loom, on account of the metal covering.

For absolute mechanical and moisture protection, the iron armored conduit is now used. It has been made with insulating linings of paper, wood, rubber, cement, enamel and asphaltic compound. The metal tube should be the minimum of metal for strength and rigidity, and the lining, besides being capable of bending with the pipe without cracking or splitting, must be impervious to heat and moisture. There has been much discussion as to whether an insulating lining is necessary in a metal pipe which is perfectly waterproof and the wires it contains are insulated up to many megohms per mile. At the World's Fair (1892) all forms of pipe tubing and conduit then manufactured were rejected, and plain iron pipe was finally adopted, in which the distribution wires were run. Although some of these wires were carrying a 2,000-volt alternating current, no faults whatever were developed. There are also thousands of miles of plain iron pipe now used for underground service for high potential mains in cities, which have given perfect satisfaction.

In spite of these facts, a thin insulating lining is always used for interior conduit work, for several reasons. All the iron pipe as now manufactured on a large scale is very rough on its interior, due to burrs, fins and splinters, and in pulling a wire through a long stretch of this pipe the insulation is very liable to be torn, especially in rounding corners, elbows, etc., in the smaller sizes of pipe. A plain iron pipe is also liable to sweat internally, and any rust due to moisture in the conduit is a menace to the insulation on the wire. Thus a thin lining is useful as tending to preserve both the pipe and the insulation.

There are two styles of iron armored conduit very extensively used, one having a lining of treated paper and the other a thin coating of enamel both inside and outside. The lining in the latter conduit is very hard and as smooth as glass, which is an advantage in inserting the wires. These iron armored conduits are manufactured in the regular gas pipe sizes externally, and in coupling the standard gas pipe threads are also used.

DISTRIBUTION.

The system of distribution to be used in a building depends to a large extent on the character of the building, whether the lights are scattered, as in the case of a business block, or arranged in groups in a large electrolier, around the stage, etc., as in the case of a theatre. One of the most general methods of distribution is shown in Fig. 3, which gives an isometric sketch of the feeder system in one wing of a modern office building. In this system of wiring all the branch circuits (not shown) on each floor are run from one or more distribution boxes or cabinets on that floor. The panel boards in these cabinets are supplied from the switchboard in the basement by a system of risers or feeders running up one of the side walls to the cabinets. In conduit work a two-wire system is usually employed throughout the building, and a separate pair of feeders run up from the switch-board to each distribution box. Or where the load is light, and separate control for each floor from the basement is not required, the panel boards on two or three adjacent floors are supplied from one pair of feeders. In order that the public lights along the halls, staircases and elevators may be independent of the other lights in the building, it is customary to run a pair of feeders from the base-

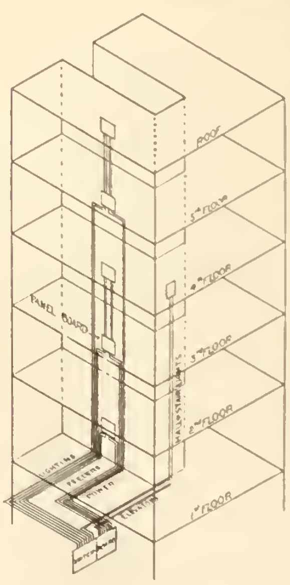


FIG. 3.—FEEDER SYSTEM.

ment to one or more separate panel-boards on certain floors from which these lights are wired. In case current is required for running motors for printing presses, etc., on some of the floors, the main panel boards on these floors are divided into two sections, one part for the lighting and the other for power service. This power section of the panel board is supplied by separate feeders from the power panel of the switch-board, from which are also run the mains for the elevator motors.

Where ventilating motors are used in a building, they are usually placed immediately under the roof and wired from the power panel in the top floor. To start or reverse these from the basement, a magnetic switch is often placed in the branch circuit to the motor, and the four small controlling wires from this switch run to the basement in one conduit. By the use of these automatic switches, motors, lights, etc., may be controlled from distant points without the expense of diverting the heavy main wires. They can be used in controlling dummy waiters from different floors, and also as the ordinary three and four point switches in lighting an electrolier from several different places. Where the building is to be wired for electric bell, telephone or ticker service, weatherproof wire is generally used throughout for this purpose, and all the wires from each floor run in a single conduit to a distribution box in the basement.

INSTALLATION.

In Figs. 4 to 11 are shown details of different parts of conduit electric wiring as installed in a fireproof office building. The

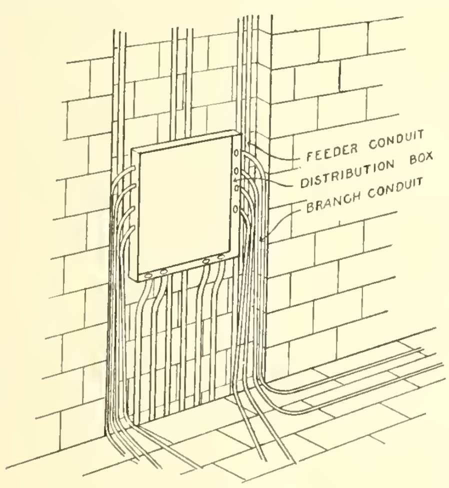


Fig. 4.—Wire Way.

conduit is installed at that stage in the construction of the building after the brickwork in the flooring and walls is finished, but before any plastering is started. Since even the smallest size of conduit (⅜") is generally too large to be covered by the layer of plaster on the brick walls, it is necessary to cut shallow channels in the brickwork wherever the conduit is to run on these walls. This is a tedious job, and is usually done by a gang of men with hammers and cold chisels before the regular conduit work is started. Where there are a number of vertical feeders requiring large conduit to be run, arrangements are made with the architect to have a recess left in the brickwork of sufficient width and one brick deep from the basement right up to the roof. A good place to run this channel for the feeders is up the elevator enclosure. This is generally in a central location, which is convenient for the panel boards, and besides this there are no windows, partitions, walls, etc., to dodge around in running the feeders to the basement. Fig. 4 shows the manner in which the feeder conduits are run in the wire way and their connection to the distribution box, also the smaller branch conduits leading from the box to the different circuits.

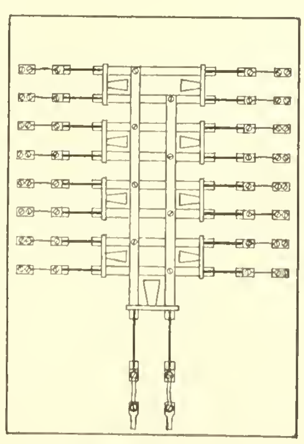


Fig. 4a.—Panel Board.

On account of the large size of wire used for the feeders, a separate conduit is generally run for each wire. If, however, an alternating current is to be used in the building, this arrangement of one conductor in an iron tube will cause a loss of energy by induced currents set up in the iron. It is thus necessary to use brass armored conduit or to neutralize this effect by running both wires in the one tube.

In the branch circuits two wires or a twin wire are almost always run to a single conduit, and the wiring differs in some respects

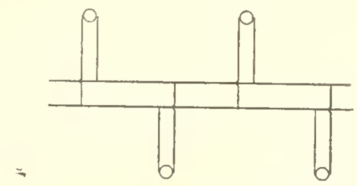


Fig. 5.—Ordinary Wiring.

from ordinary methods. In ordinary work, where a number o lights are installed in a room, the mains are run down the length of the room and branches tapped off to each lamp, as shown in Fig. 5. In conduit work, however, no tee's are placed on the conduit, and a zig-zag path is taken from one outlet to the next. In afterwards inserting the wires they are run to the furthest outlet, and, working back, a loop is left at each of the other outlets, to

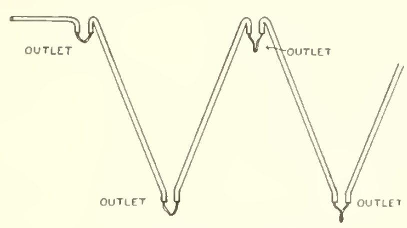


Fig. 6.—Loop System.

which the wires from the fixture are connected. Thus in this "loop system" (Fig. 6) the branch wires are not cut at any place between the panel board and the furthest outlet, so that if larger wires are afterwards required, the different fixtures may be disconnected, the old wires pulled out from end to end, and the larger wires inserted.

Some details of the conduit work on branch circuits are shown in Figs. 7 and 8. It will be noticed that the conduit is run on the

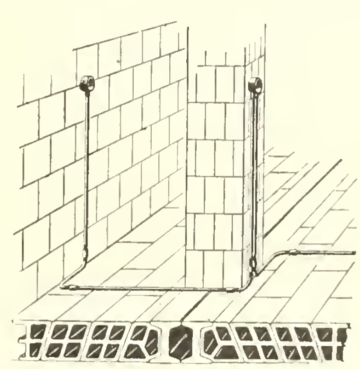


Fig. 7.—Details of Branch Circuits.

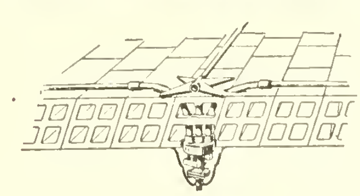


Fig. 8.—Details of Branch Circuits.

brick flooring and not across the ceilings. This is because the plaster on the ceilings is not thick enough to cover the iron armored conduit, and since the brick flooring is afterwards covered by two to four inches of cinders, over which asphalt or the floor boards are laid, the tubes are completely concealed. In both these figures outlet boxes are used, into which the ends of the conduit at the outlet are sealed. These outlet boxes are made of iron, with a lining of the same material as that used in the conduit. Two common forms are shown in Figs. 9 and 10, the first of which is an outlet box shaped to act as a receptacle for a flush switch. Fig. 10 gives a form used at a bracket outlet, showing the nipple on the cover by which the bracket is supported. In many buildings, however, outlet boxes are not used, especially for bracket and ceiling lights, the conduit being trimmed off nearly flush with the plaster and the fixture connected up in the usual manner. When one or more branches are to be tapped off the mains for an electrolier, etc., a "junction box" is used. These are very similar to outlet boxes and often contain a branch

cut out, making them practically a distribution box on a small scale.

The wiring in the basement is usually run open, i.e., not concealed in the plaster, and is often run in flexible conduit or on porcelain knobs, though for fireproof work the iron armored con-

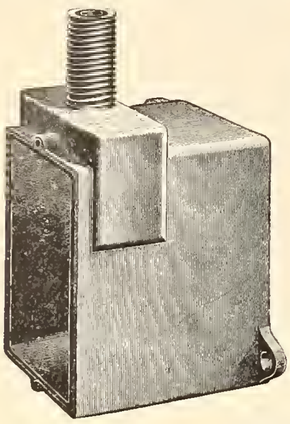


FIG. 9.—OUTLET BOX.

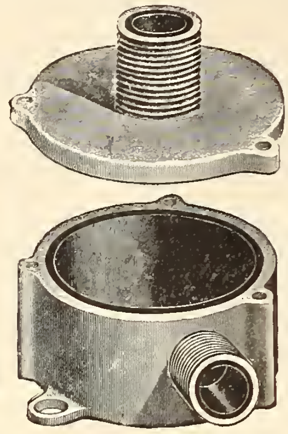


FIG. 10.—OUTLET BOX.

duit is continued to the switchboard. A very useful support, made from gas pipe, for carrying the conduit in the basement is shown in the upper portion of Fig. 11. This figure also shows a form of switchboard suited to the feeder system in Fig. 3, each pair of feeders being controlled by a double pole switch.

It is not permitted when installing the conduit to run cords in the stretches as they are put up, to facilitate pulling the conductors through afterwards, as this might make poor construction possible; that is, it would be an easy matter to pull even large wire through a conduit having rough, poorly made joints, which would abrade the insulation on the wire. When the wire is run through the conduit properly, it is practically a gaurantee that the conduit has been well installed or the conductors could not be inserted. For this same reason, it is important to have all necessary curves as gradual as possible or difficulty will be had in running the wires afterwards. In making a correct joint in iron armored couduit, a wheel pipe cutter is used to cut merely through the outer iron armor, a hack-saw being used to saw through the lining. A reamer is then used to trim up the end of the conduit before it is threaded. A jack-knife is often used in-

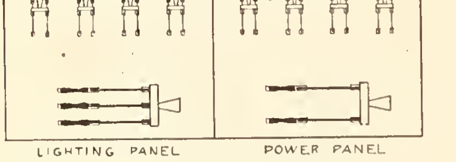


FIG. 11.—SWITCHBOARD.

stead of the reamer, but a poor job is generally the result. Care should also be taken that the white lead used in sealing the joint does not get between the ends of the conduit. This can be prevented by giving the coupling a turn or two on the conduit, and then applying the lead to the thread on the outside of the conduit.

The actual wiring of the building by running the conductors through the conduit is not done till all the plastering, flooring, etc., is over and the building is nearly finished—in fact, the wires are often run and the fixture work done at the same time.

There is not much difficulty in running the risers or feeders, as the conduit is large, and the wire, where larger than No. 6, is generally a stranded conductor. On the horizontal branch circuits, however, with many turns and using twin wire, the problem is not so simple. The inside surface of the conduit is first rendered smooth by blowing some powdered soapstone out of a horn through a section of the conduit. A steel tape about $\frac{1}{16}''$ wide and as thick as a clock spring is then passed through the conduit, after which the wires may be run. The tape is always run downwards if possible from a higher to a lower outlet. An ordinary stretch for a run is from fifty to eighty feet with three or four turns, though it is sometimes possible to thread the steel tape nearly two hundred feet on a horizontal run.

In conclusion, it may be stated, that on account of the high standard of insulation now used on wire, any system of wiring is practically perfect where the insulation is protected from mechanical and chemical injury. The system to be employed in any special case depends on the circumstances. In some cases one system may be perfect, while in others it is expensive and unnecessary. In the best practice iron armored conduit is used in fireproof buildings or where the wiring is embedded in plaster or brick work. For the ordinary class of buildings with wooden joists, etc., where there is no liability of mechanical abuse, porcelain work is perhaps as good a system as can be used. In any case, where the wiring is properly done, the incandescent electric light—in contrast to the explosive and poisonous character of ordinary lighting gas—is probably the safest method of illumination yet devised by man.

THE BURSTING OF SMALL CAST IRON FLY-WHEELS.

MR. Chas. H. Benjamin, of Cleveland, Ohio, in a paper presented recently to the American Society of Mechanical Engineers on the above subject, states the following as his conclusions on the subject, based upon careful experiments:

1. Fly-wheels with solid rims, of the proportions usual among engine builders and having the usual number of arms, have a sufficient factor of safety at a rim speed of 100 feet per second if the iron is of good quality and there are no serious cooling strains. In such wheels the bending due to centrifugal force is slight, and may safely be disregarded.

2. Rim joints mid-way between the arms are a serious defect and reduce the factor of safety very materially. Such joints are as serious mistakes in design as would be a joint in the middle of a girder under a heavy load.

3. Joints made in the ordinary manner, with internal flanges and bolts, are probably the worst that could be devised for this purpose. Under the most favorable circumstances they have only about one-fourth of the strength of the solid rim, and are particularly weak against bending. In several joints of this character, on large fly-wheels, calculation has shown a strength less than one-fifth that of the rim.

4. The type of joint exemplified in Nos. 16 and 17 is probably the best that could be devised for narrow-rimmed wheels not intended to carry belts, and possesses, when properly designed, a strength about two-thirds that of the solid rim.

It is gratifying to notice the fact that since the subject of joints in fly-wheel rims has been so thoroughly ventilated during the discussions before this society, several of our prominent engine builders have changed the designs of their wheels by bringing the rim joints opposite the ends of the arms. The experiments which have just been described, although at times a trifle too exciting, were interesting from first to last. The writer hopes to supplement them by others on models of the more recent rim-joints, and would be glad to receive any suggestions. The more this subject is agitated, the less shall we have occasion to mourn the destruction of life and property on account of faults in the design of this most necessary element of the steam engine.

Mr. C. H. Meredith, of Ottawa, is working on an invention to prevent anchor ice.

PROPOSED WATER POWER DEVELOPMENT AT SHAWINIGAN FALLS, QUE.

A WATER power development of rather unusual interest, the construction of which will soon be commenced, is that of the Shawinigan Falls, on the St. Maurice River, P.Q. This power and over 800 acres of land adjacent thereto are owned and will be developed by the Shawinigan Water and Power Company, of Montreal.

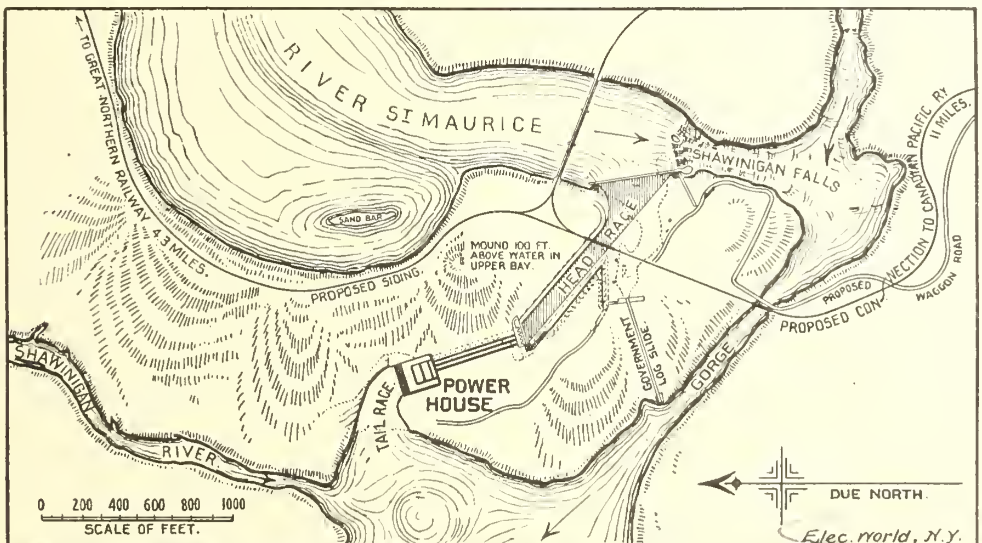
At these falls the river, which is one of the largest in Canada, draining some 18,000 square miles of territory, drops over 140 feet in a very short distance. The extraordinary formation of the peninsula of land lying between the upper and lower levels of the river above and below the falls, and the way in which the river turns at more than a right angle to its course after hurling itself down the main cascade, here affords what is undoubtedly one of the most favorable natural locations for a water power development in the world.

Owing to the nature of the country drained, which is densely wooded throughout, the flow of water in this stream is very steady throughout the year. At lowest water it is calculated that sufficient water passes over the falls to develop 190,000 horse-power, under the working head of 120 feet, on the shafts of turbines having 80 per cent. efficiency. Of this amount 150,000 horse-power could safely be used.

The falls are favorably situated as regard saccess to rail and water shipping facilities. The Great Northern Railway, which is a link in the short line route from Chicago and Parry Sound to Quebec by way of Ottawa, passes close to the falls, and the construction of a siding 4½ miles long to this road will be commenced in the early spring. This will give communication with Quebec, 90 miles distant in one direction, and with the great west by the shortest known route, in the other direction. The Canadian Pacific Railway, Canada's transcontinental line, passes within 10 miles of the falls on the opposite side of the river, and a siding from this road has been located by the engineers. The operation of the Montreal and Quebec division of the Canadian Pacific Railway and a considerable section of the Great Northern Railway by electricity, using either the trolley or the third-rail system, is claimed by the engineers to be well within the commercial possibilities of this development.

Three Rivers, a town of 9,000 inhabitants, at the junction of the St. Maurice river with the St. Lawrence river, and 17 miles distant from the falls, is a seaport with excellent shipping faciiities, which afford means of water communication with the ocean and the great lakes for eight months in the year. The Canadian Pacific Railway passes through this town, and the Grand Trunk railway is reached by means of a ferry to the opposite shore of the River St. Lawrence. It is intended to transmit power under 20,000 volts pressure to this town for manufactures of various kinds on an extensive scale.

The present development, for which contracts have been let, and on which construction will be commenced shortly, will consist of the installation of turbines and generators for 30,000 horse-power, with provision for extension up to 150,000 horse power. Twenty thousand horse-power of this will be in the form of alternating current for transmission to Three Rivers, and 10,000 horse-power in low-voltage direct current, to be used in various electro-chemical industries in the vicinity of the falls. The water is to be taken in from the side of the river just at the head of the falls, and carried back in a head-race 1,200 feet long, 100 feet wide and 16 feet deep. The arrangement of the head-race entrance will naturally tend to allow the draft over the falls to carry off the frazil and anchor ice which is such a bugbear to all engineers who have to deal with water powers in Canada.



MAP SHOWING PROPOSED WATER POWER DEVELOPMENT AT SHAWINIGAN FALLS.

The bulkhead is to be of concrete, with steel grates operated by pneumatic pressure, in front of feeder-pipe inlets, and from here the water will be carried down in steel feeder pipes 13 feet in diameter and about 550 feet long. Each of these pipes will carry sufficient water to develop 10,000 horse-power net, under the working head of 120 feet. Two of the pipes will be connected to two pairs of twin turbines, each of 5,000 h.p. capacity, running at 300 revolutions per minute, each direct connected to an alternating-current 5,000 h.p. generator. These generators will be among the largest horizontal shaft generators yet built, and will weigh in the neighborhood of 100 tons. A pair of gate valves 78 inches in diameter, with pneumatic lift, will control each unit of 5,000 horse-power, so that should one unit require to be stopped, the opposite one on the same pipe can be kept running. The turbines operating the direct-current generators will consist of four pairs of twin turbines, each of 2,500 h.p. capacity, having two direct-connected generators, one on each end of

the driving shaft. Each of these 2,500 h.p. units will also be controlled by separate gate valves.

A special feeder pipe 4 feet in diameter will run the exciters and the air compressor, supplying air for the operation of gate valves, switches, etc. All the feeder pipes are to be coned down and provided with numerous pop valves and large air cushion cylinders to relieve water hammer. The governors will be operated by compressed air, and in operating the cylinder gates of turbines a novel arrangement has been devised, so that no moving part of the mechanism will operate under water. Roomy tunnels well above back-water level will run between the generators and switchboards and transformers. The switches will be operated by compressed air, and the switchboard is so located as to overlook all the generators and exciters.

The transmission lines to Three Rivers, operating under a pressure of 20,000 volts, will be two in number, one on each side of the river, so as to avoid the risk of total loss of line from forest fires which might occur in the wooded country through which the lines will pass. These lines will be 17 miles long, of which 15 miles will be dead straight. Wire will be bare copper, on triple petticoated insulators set on suitable cross arms on heavy cedar poles set 6 feet into ground, 100 feet apart.

A triple line of lightning arrestor wires, grounded at every fourth pole, will be carried over the transmission lines. The transformers at both ends will be oil-filled self-cooling.

Messrs. T. Pringle & Son, of Montreal, are the company's engineers for both the hydraulic and electrical development, W. C. Johnson, engineer of the Niagara Falls Hydraulic Power & Manufacturing Company, being consulting engineer. Wm. Israel Bishop will be engineer in charge, and F. H. Leonard will have charge of the designing and installation of electrical apparatus.

For the above particulars we are indebted to the Electrical World.

INSPECTION OF STEAM BOILERS IN BRITISH COLUMBIA.

The Legislature of the province of British Columbia has passed a bill, which received its third reading on February 13th last, to provide for the inspection of steam boilers. It is entitled "An Act respecting the Inspection of Steam Boilers," and is as follows :

ACT RESPECTING THE INSPECTION OF STEAM BOILERS.

Her Majesty, by and with the advice and consent of the Legislative Assembly of the Province of British Columbia, enacts as follows :

1. This Act may be cited as the "Steam Boiler Inspection Act, 1899."

2. The expression "boiler" wherever the same occurs in this Act includes the steam engine or engines, and every part thereof, and all apparatus and things attached to and connected therewith, or used with reference to any such boiler or engine.

3. This Act shall not apply to railway locomotives on railways under the supervision of the Dominion of Canada, nor to any boiler subject to inspection under the laws of the Parliament of Canada, nor to any boiler with a capacity of two horse power or under.

4. The Lieutenant-Governor in Council may constitute such portions of the Province as he may think proper into Steam Boiler Inspection Districts, and may, from time to time, alter such districts.

5. For each of such districts the Lieutenant-Governor in Council shall appoint an Inspector, to be called Inspector of Steam Boilers.

6. It shall be the duty of each Inspector to inspect the steam boilers within his district before the same shall be used, and once at least in each year to inspect and thoroughly test all steam boilers within his district.

7. Nothing in this Act shall be construed to prevent the use of any boiler or steam generator which may not be constructed of riveted iron or steel plates, when the Inspector has satisfactory evidence that such boiler or steam generator is equal in strength and as safe from explosion as boilers of the best quality constructed of riveted iron or steel plates.

8. (1.) Every steam boiler shall be provided with a fusible plug, approved by the Inspector, inserted in the flues, crown sheet or other part of the boiler most exposed to the heat of the furnace when the water falls below the prescribed limits, so that the plug will fuse and put out the fire.

(a.) Each boiler shall have a safety valve of approved pattern of not less than one square inch of area to three square feet of grate surface ; if it be a water tube boiler, it shall have one square inch of area to six square feet of grate surface. This safety valve shall be set by the Inspector to the pressure of steam allowed by him.

(b.) No person shall alter in any way the weight, or if a spring loaded safety valve is used, no one shall alter the spring so as to carry a greater pressure than allowed by certificate of Inspector, under a penalty of not exceeding one hundred dollars.

9. Every steam boiler shall also be provided with one or more steam gauges, tricocks, gauge glass and safety valve, tested annually, unless the Inspector shall specially certify the same to be unnecessary.

10. The certificate of inspection to be granted under this Act shall be in the form set out in Schedule A.

11. The said certificate, together with a copy of sections 21 and 22 of this Act, shall be posted up, and be kept posted up in a conspicuous place on the steam boiler, or in the engine room where such steam boiler is being operated, in such place as the Inspector shall direct, and no person operating such steam boiler shall operate the same at a higher pressure than that authorised in the certificate.

12. (a) An appeal shall lie from any ruling or decision of an Inspector, to the Chief Commissioner of Lands and Works, whose decision shall be final, and the said Chief Commissioner shall have power to order the payment of a reasonable sum for costs, and in case of default in payment pursuant to such order, the same may be recovered in any Court of competent jurisdiction by the party or parties to whom awarded.

(b) In any appeal it shall be lawful for the Chief Commissioner of Lands and Works, if he think fit, to summon to his assistance an expert engineer who shall attend and assist accordingly.

13. In addition to the annual inspection, it shall be the duty of each Inspector to examine at any time, when in his opinion such examination shall become necessary, all such steam boilers within his district as shall become unsafe from any cause, and to notify the owner or person using such steam boilers of any defect, and what repairs are necessary in order to render them safe.

14. The Inspector shall have the right, at all reasonable hours, to examine steam boilers in course of construction or repair, and to refuse to grant a certificate for any steam boiler found to be defective according to the provisions of this Act, or of which such examination has been refused.

15. Each Inspector shall keep a register of the inspections and certificates made and granted by him, of all repairs ordered by him, of all steam boilers condemned by him as unsafe, of all accidents to steam boilers whether by explosion or otherwise, and of all casualties that may happen or occur in connection with steam boilers within his district.

16. The Chief Commissioner of Lands and Works may order an investigation to be made, by any person or persons, into the cause of any accident to any steam boiler, attended or not attended with loss of life, and the person or persons so appointed may summon witnesses and compel their attendance before him or them, by the same process as Courts of Justice, and may administer oaths and examine witnesses touching the cause of such accident, and shall report thereon to the Chief Commissioner.

17. Each Inspector shall annually, on or before the first day January, send to the Chief Commissioner of Lands and Works a concise report of all inspections and transactions connected with the performance of his duties, and of all accidents and

casualties to steam boilers, whether by explosion or otherwise, that have happened or occurred within his district during the year.

18. The fees to be paid for inspection and the salary of the Inspectors shall be fixed by the Lieutenant-Governor in Council.

19. Every person who constructs steam boilers known to be imperfect, or who drifts any rivet hole to make it come fair, shall be liable to a fine of two hundred dollars.

20. It shall be the duty of owners or managers of steam boilers to allow the Inspector free access to the same, and to furnish water and fill the boiler and remove the jacket or covering when directed by the Inspector, to enable the Inspector to make a proper test, and all engineers operating such steam boilers shall assist the Inspector in his examination, and shall point out to him any defect that they may know or believe to exist in the steam boiler in their charge, subject to a penalty of not less than twenty dollars nor more than three hundred dollars.

21. Any person operating a steam boiler, as well as the lessee or owner thereof, in case the same is being operated with his consent, without there being an unexpired certificate of inspection thereof, shall be liable to a penalty of five dollars a day for each day that he shall operate such uncertificated steam boiler; provided, however, that the penalties herein enacted shall not take effect until after the expiration of four months after this Act shall have come into force, nor in cases where there is no such certificate owing to the neglect or default of an Inspector.

22. It shall be the duty of the person operating or owning any boiler pronounced by the Inspector unsafe, to cease to use the same until such repairs as are indicated by the Inspector are made, and in case of failure to comply with the requirements of the Inspector, the person owning, as well as the person operating, any such boiler shall be liable to a fine not exceeding one hundred dollars, and shall also be liable for any damage to person and property resulting therefrom.

23. Any Inspector who shall wilfully certify falsely regarding any steam boiler shall, on conviction, be liable to a fine of not less than fifty dollars and not exceeding five hundred dollars.

24. Any person violating the provisions of section 11 of this Act shall be liable to a penalty of not less than ten dollars and not more than fifty dollars.

25. No Inspector shall act as agent for the sale of boilers under a penalty of removal by the Lieutenant-Governor in Council.

26. Any penalty recovered under this Act shall form part of the Consolidated Revenue Fund.

27. All penalties imposed under this Act shall be recoverable before a Justice of the Peace, a Police Magistrate, or a Stipendiary Magistrate. Such Justice of the Peace, Police Magistrate, or Stipendiary Magistrate, in case the penalty awarded by him be not forthwith paid upon conviction, with such costs as shall be awarded, shall levy the same by distress and sale of the goods and chattels of the offender, by warrant under his hand and seal.

28. In default of the payment of the penalty and costs, or of sufficient distress, the offender may, by warrant under the hand and seal of the convicting Justice of the Peace, Police Magistrate, or Stipendiary Magistrate, be imprisoned in the nearest goal or lock-up for a period of not less than fourteen days, and not more than six months, at the discretion of such Justice of the Peace, Police Magistrate, or Stipendiary Magistrate.

29. No conviction or warrant of commitment under this Act shall be vacated, quashed or set aside for want of form, or be removed by writ of certiorari or other process into the Supreme Court.

30. (a) The Lieutenant-Governor in Council may make rules and regulations for the testing of steam boilers, and all matters connected with the construction and working thereof, including the examination of persons in charge of same.

(b.) Any rules and regulations made under the authority of this section, shall, after publication in the British Columbia Gazette, have like force and effect as if herein enacted.

SCHEDULE "A."

CERTIFICATE OF INSPECTION OF STEAM BOILER.

PROVINCE OF BRITISH COLUMBIA. } This certificate expires 18 .

I hereby certify that I have this day inspected the steam boiler owned by of in the Province of British Columbia [GIVE DISCRIPTION OF STEAM BOILER BY WHICH IT MAY BE READILY IDENTIFIED], and having carefully examined said steam boiler, have found the same in condition, and therefore authorize a steam pressure of pounds to the square inch and no more.

Dated this day of 18

INSPECTOR.

MUNICIPAL LIGHTING PLANT AT ACTON.

THE village of Acton, Ont., is now supplied with arc and incandescent electric lights by a municipal plant, which was started up for the first time on January 28th, just two months and one week after the contracts were signed.

The power house is a stone structure, 24 × 50 feet, floored with maple, with walls and trimmings of dressed red birch. The engine and dynamo room is 24 × 37 feet, and the boiler room 24 × 13 feet. The engine is of the Wheelock type, capacity 75 h.p. nominal; and the boiler 90 h.p. These were supplied by the Goldie & McCulloch Co., Galt, and uphold the reputation of that well-known firm. The dynamo is a fifty kilowatt alternating current machine, with a capacity of 1,000 incandescent lights. There is a fine two-panel marble switchboard, with full complement of controlling instruments, and 56 32 c.p. incandescent street lamps, arranged in two circuits independent of each other, and a third circuit for domestic and commercial service, also independent. The electrical machinery, wiring, etc., was contracted for by the W. A. Johnson Electric Company, of Toronto. The main driving belt is 16 inches, 65 feet long, and the dynamo belt is a 10 inch, double, endless. Both were supplied by the belting department of the Acton Tanning Company.

Mr. Reynolds, the electrician, had the general oversight of plans and arrangements; Messrs. Forbes and Graham of the erection of the power house; Mr. W. Cowan, of the Goldie & McCulloch Co., of the placing of the boiler and engine; and Mr. H. J. Hurd superintended the construction of the electrical work for the W. A. Johnson Electric Co.

MOONLIGHT SCHEDULE FOR MARCH.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 6.10	P.M. 11.30	5.20
2....	" 6.10	A.M. 1.00	6.50
3....	" 6.10	" 1.30	7.20
4....	" 6.10	" 2.40	8.30
5....	" 6.20	" 3.30	9.10
6....	" 6.20	" 4.20	10.00
7....	" 6.20	" 5.10	10.50
8....	" 6.20	" 5.20	11.00
9....	" 6.30	" 5.20	10.50
10....	" 6.30	" 5.20	10.50
11....	" 6.30	" 5.20	10.50
12....	" 6.30	" 5.10	10.40
13....	" 7.40	" 5.10	9.30
14....	" 8.40	" 5.10	8.30
15....	" 9.40	" 5.10	7.30
16....	" 10.50	" 5.10	6.20
17....	" 11.00	" 5.10	6.10
18....	" 11.50	" 5.10	5.20
19....	....	" 5.10	4.30
20....	A.M. 12.40	.....	
21....	" 1.20	" 5.00	3.40
22....	" 2.00	" 5.00	3.00
23....	" 2.30	" 5.00	2.30
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	No Light.	No Light.	.....
27....	No Light.	No Light.	.....
28....	P.M. 6.50	P.M. 9.20	2.30
29....	" 6.50	" 10.20	3.30
30....	" 6.50	" 11.30	4.40
31....	" 6.50	A.M. 12.30	5.40
		Total.........	185.30

THE PITTING OF BOILERS. Investigations have been made by M. Olory, a French engineer, in regard to the pitting of boilers, the result showing that the powder thus formed contains 86.29 per cent. peroxide of iron, 629 per cent. of grease and other organic matter, and 4.25 per cent. of lime salts. In one of the tests resorted to a polished iron bar was first immersed in a natural water containing much oxygen and no lime salts; the bar gradually rusted, the corrosion ceasing when the oxygen was used up — the bar being now removed, repolished, and put back, it remained perfectly bright. Repeating the experiment, with water containing lime, the rusting was much less complete, the lime salts forming a protective layer on the iron, but on polishing this off corrosion recommenced. In distilled water the bar remained quite bright. The corrosion is much more rapid if the water contains carbonic acid gas as well as oxygen.

MONTREAL

(Correspondence of THE CANADIAN ELECTRICAL NEWS.)

McGILL UNIVERSITY LECTURE—"ELECTRICITY AS A FACTOR IN MODERN DEVELOPMENT."

The annual university lecture of McGill was delivered on February 17th before a large and representative audience, the lecturer being Prof. R. B. Owens, chief of the electrical department. Prof. Owens chose as his subject "Electricity as a Factor in Modern Development." At the outset he referred briefly to the relation of the world's material and social progress to the work of the engineer—the man who economically converts the materials and forces of nature to useful and social ends. A single invention—the steam engine—had made more history in its short life than half the world's rulers. By the introduction of electric traction, not only had the sanitary conditions of our cities been improved, but healthy country homes had been substituted for the overcrowded tenement. Electric traction was not dangerous at higher speeds than is possible with horses, and the small cost of electric operation permitted of low fares being charged. The effect of rapid transit on urban architecture was also plainly seen.

In regard to electric power for industrial purposes, Prof. Owens said that he thought the change from older methods of factory driving to the present one of using electric motors had a distinct and elevating influence upon the character of the men employed. So scrupulously clean, cheerful and healthy had many modern shops become, that positions in them are eagerly sought by persons of both sexes of genuine culture and refinement. For example, the Weston Electrical Instrument Company, of New Jersey, were erecting a new shop for the manufacture of their famous instruments, in which not only are mauual operations reduced to a minimum, and a pure sunlight effect maintained by skilful coloring and the intelligent use of electric lights, but the very air the employees breathe is first mechanically cleansed of every germ and dust particle it contains.

The question of the place of engineering in the coming university was dealt with. The speaker said that just as a general knowledge of science had become to be considered an essential in every course intended to afford a liberal education, so a general knowledge of the applications of the science would likewise be regarded. In other words, the broad principles of engineering would be included in every university course, and the special branches would be taught in graduate technical schools. But this would not come immediately—not until the supply of engineers more nearly equalled the demand for them, for only then could they be expected to spend more than four years in preparation for their work. For the present, then, electrical as well as other special branches of engineering must be conducted as undergraduate work, but so rapid have been the advances in the development of electricity, and so vast are the facilities for experiment possessed by the larger manufacturing companies, that the school is in general behind the factory. Consequently, every effort must be made to keep in close touch with best current practice. This it would be sought to accomplish in two ways—first, by equipping the electrical laboratories with the best facilities for investigation that could be obtained, most of the machines upon which tests are to be made being supplied by the manufacturing companies, as different new types are developed ; and, secondly, by having practical engineers, engineers of the better electrical manufacturing companies, and others engaged in special work, deliver lectures on special subjects from time to time.

Prof. Owens said that few, if any, schools of electrical engineering were more happily situated than McGill. With the splendidly equipped factories of the Canadian General Electric Company at Peterborough, the Royal Electric Company at Montreal, and the magnificent water power developments at Lachine and Chambly, all within easy reach, the student would quickly learn the bearing of his subject upon the commercial and industrial interest of the Dominion, and it was the speaker's highest ambition that the splendid water powers of Canada should be guided into useful channels largely by graduates of McGill University.

Prof. Owens then returned to his original subject, and traced in more detail the developments in the several branches of electrical work. His remarks in this connection are given below in full :

ELECTRIC LIGHTING.

Sir Humphery Davy, with a battery of copper zinc elements, gave us the electric arc in 1810, by passing a current of electricity between the ends of carbon pencils held a small distance apart in air, but the generation of electricity by chemical means was then, and still is, too expensive for commercial use. It was not until after the discovery of the principle of the dynamo by Henry in 1830, and Faraday in 1831, that the way was opened for the general application of the most beautiful and easily managed of all forms of physical energy.

Coupled with the steam engine and water wheel, the dynamo converts the solar energy of our coal fields and waterfalls into a subtle and powerful force, whose applications are literally without number.

Unaffected by gravity or temperature, capable of indefinite subdivision and highly efficient conversion, and requiring the simplest of all means of conveyance—a stationary metal conductor—no limit can be put upon the use of electric power.

By 1870 the dynamo machine might be said to have reached a commercial form, but the problem of electric lighting was not solved until 10 years later. On February 5th, 1880, Mr. Edison filed an application for a patent on a system of electric lighting involving the use of high resistance electric lamps, arranged in multiple circuit across the terminals of a low resistance dynamo, solving by this combination the then serious problem of the subdivision, as it was called, of the electric light.

In September, 1882, the Edison Electric Illuminating Company of New York, started their Pearl street central station, to supply current on a commercial scale to the down-town or business districts of the city, and within the next few years about this old station were worked out many of the problems of central station practice.

So rapidly were the advantages of the incandescent lamp appreciated for interior lighting, and the electric arc for street illumination, that in less than a single generation from fifteen to twenty million incandescents and nearly half a million arcs are now in use in a single country—the United States.

In the early days of the industry when the problems of insulation and distribution were imperfectly understood, it was necessary to use low electric pressures and to place the central station close to the district to be supplied, but now that we have become familiar with pressures of ten, twenty, thirty and forty thousand volts, and the possibilities of alternating currents for transmission and distribution are better known, the station may be located well outside the limits of the average city, feeding into suitable substations wherever current is required. This means both a great economy in the cost of generation and the absence of the familiar smoke nuisance.

The most notable example of this practice of concentrating all generating machines in a single plant at a distance from the districts to be supplied, is that of the Third Avenue Railway Company, of New York. They are now installing the largest steam electric plant in existence, consisting of sixteen 6000 horse power dynamos, having a combined capacity of nearly 100,000 horse power, the equivalent of more than a million 16 candle power incandescent lamps. The station will be situated on the upper end of Manhattan Island, by the East River, and will distribute current by underground conductors, at a pressure of 10,000 volts, to sub-stations in all parts of the city. From the sub-stations current will be supplied for surface and elevated railways, electric lighting, motors, etc. Aside from the economy affected, this arrangement will have a tremendous effect in purifying the atmosphere of New York. But no such scheme is necessary here.

Happy, and thrice happy, should the people of this city be, because of the magnificent water power that is being developed at her very gates. Within easy reach of Montreal there is more hydraulic power than in the whole of Switzerland, and when fully developed and electrically applied we should have here the electric city of the Dominion. But as brilliant as have been the advances in electric science, we are still far short of what we hope the future holds.

CONVERSION OF ENERGY.

The two engineering problems that excite most interest to-day, are the efficient conversion of the energy of fuel into electric energy, and the conversion of electric energy into light, without accompanying heat. The steam engine converts only from five to ten per cent. of the chemical energy of coal into mechanical power, while the dynamo converts from ninety to ninety-five per cent. of the mechanical power it receives into electric power. In point of efficiency the dynamo is practically perfect, but all thermal

engines are subject to laws which under working conditions sadly limit their efficiency. Therefore, the effort is being constantly made to convert the chemical energy of carbon directly into electric energy without passing through the form of heat, a process essentially similar to the conversion in the ordinary zinc-copper battery, but, so far, no practical carbon battery has been produced. Indeed, it is doubtful if the art of government is sufficiently far advanced to withstand the social strain that such a revolutionary invention would produce. It would mean unlimited power at practically no cost, and would occasion industrial and social changes beside which those produced by the steam engine would dwindle to a vanishing point.

The efficiency of the incandescent lamp, though somewhat improved in late years, is still extremely small—only some three per cent.—the major portion of the electric power supplied being dissipated as radiant energy of a wave length too great to be appreciated by the eye.

Vacuum tube lighting, at high frequencies and high potentials, promises something, but the results so far obtained have not been all that was anticipated.

If our modern lighting apparatus could be brought to the efficiency of that of the glow worm and fire fly, the consumption of a few tons of coal per hour would light the world.

ELECTRIC POWER.

If a coil of wire is made to revolve between the poles of a magnet, a current of electricity will be generated in the wire, and conversely, if a current of electricity is sent through the coil from an external source, it will tend to move. In the one case we have a dynamo, in the other a motor. By different arrangements of magnets and different groupings of conductors, all the many types of electric machinery now in use have been evolved, but an inspection will show that modern dynamos and motors consist esentially of but two parts ; a stationary element, and an element having a pure rotary motion. This is the acme of mechanical simplicity, and when other features of the electric motor are considered, its small weight for a given output, the absence of noise, heat and odor, its ability to operate in any position, and under any atmospheric conditions, we are justified in thinking that a more perfect source of power could hardly be conceived.

Power distribution by electric motors, though first developed in conjunction with electric lighting, not only now exceeds many times the electrical interests, but has become one of the largest commercial enterprises of the globe. In 1898 more than a milion horse power in electric motors was employed in America in street railway transportation alone, conveying, by a recent estimate, more than three billion passengers, and earning something like $125,000,000. These same railroads employ an army of 200,000 men, and represent an invested capital of from one to one and one-half billion dollars.

When we further consider the aggregate capacity of the thousands of motors employed in the distribution of power for other than traction purposes—in machine shops, cotton mills and sugar houses, in printing, pumping, hoisting, and ventilating, on modern warships for steering, handling ordnance, etc., to say nothing of the apparatus used in the transmission of power, as distinct from power distribution—we begin to form some adequate idea of the influence of this new agent.

Before the invention of the steam engine, waterfalls were of first importance as sources of power, and usually attracted settlements about them, but after Watt's discovery and Stephenson's application to the locomotive, it was found more convenient to transport the new source of power—fuel—to different established centres of population, instead of moving the centres of population to the sources of power. With the advent of electricity, however, not only have water powers acquired a vastly increased value by reason of the ease with which their energy can be economically transmitted over great distances, but electrical methods of distribution have in some cases actually superseded the railway for fuel energy transference, a case in point being the recently established plant of the Colorado Springs Power Company, for the transfer of the energy of coal from a low geographical level to a higher one without the necessity of overcoming gravitational forces.

The first experiment to reveal the astonishing possibilities of electric power transmission was made in 1891. In that year some 200 horse power was transmitted over a wire, roughly one-tenth of an inch in diameter, from Lauffen to Frankfort-on-the-Main, a distance of 108 miles, with a total loss in transmission and conversion of less than 30%, and this with an electric pressure not so great as will be used between Chambly and this city.

About the same time, plans were in preparation for harnessing the mightiest of all Nature's water powers—Niagara Falls—and a commission appointed to consider methods, including, among other distinguished scientists and engineers, Lord Kelvin, of Glasgow, and Professor Unwin, of London, after carefully considering all known means of power transmission, unanimously adopted electricity. To-day, about a mile above the falls, some 50,000 horse power is continuoulsy flowing from half a score of huge electric spinning tops. No feat of modern engineering has been watched with greater interest than this, and none more successfully conducted.

Though time does not permit me, nor would you find it of interest to go into details, I may mention that the power of Niagara has been estimated at about 7,000,000 horse power—greater probably than the physical force the whole human race is capable of continuously exerting. At present some 250,000 horse power is to be developed on the American and Canadian sides, or about 5 per cent. of the total power available—not enough to perceptibly diminish the flow over the falls. However, should the whole be utilized, leaving the rocky river bed dry and bare, we should but be substituting a wonderful cataract of etheric energy for the splendid flow of gravitational matter so justly famed. Which spectacle would present greater beauty would depend upon the individual.

To those who trace in imagination the course of a beam of sunlight, as it buries itself in the ocean, rises in cloud, and falls again in grateful shower over grain field and vineyard, filling brook and swelling river, and finally tumbling through mighty turbines and silently streaming from the polished slip rings of stately dynamos, bursting again into wholesome sunlight, to brighten the homes of hundreds, the substitution would but be the completion of a full cycle of usefulness and beauty. From either standpoint, however, Canada is fortunate, for she has water power enough and to spare. Some of this is already being splendidly developed, but much will not be needed for many years.

Among the best examples of electric transmission in the world are the plants at Lachine, Chambly and Hamilton. The latter plant started in September last, and is now transmitting some 2,500 horse power thirty-five miles, at the enormous pressure of 22,500 volts. The two former I suppose most persons in Montreal have had the pleasure of seeing.

The question is often asked, will electricity eventually supersede the locomotive on the present steam railroads? I may reply that careful estimates show no economy of electricity over steam for the handling of heavy freight traffic where the number of trains operated per day is small, but for passenger service, where trains must be operated at frequent intervals on small headway, the advantage is with electricity, and it is probable that because of the smaller cost, as well as increased speed, such cities as New York, Baltimore and Washington will be connected by through lines in the near future.

It is also of interest to inquire as to the probable limit of economical power transmission by electrical means. In reply to this I may say that Lord Kelvin, after an inspection of the Niagara plant in 1897, is quoted as placing the limit at about 300 miles.

At Snoqualmie Falls, Washington, there is now being installed a 6,000 horse power plant, to supply power to the cities of Seattle and Tacoma—one 31 and the other 45 miles distant. The pressure used is 25,000 volts. This voltage, though perhaps the highest in commercial use for so large an amount of power, is by no means the limit of practicable electric pressures, small amounts of power being transmitted commercially at pressures as high as 40,000 volts, and to distances of 85 miles. Recent experiments show that the leakage losses in a well constructed transmission line are practically negligible up to pressures of from 50,000 to 60,000 volts. Beyond this, however, such losses seem to increase rather rapidly.

It is estimated that about 200,000 horse power of electrical machinery is now in use on the American continent for transmitting the power of falling water.

TELEPHONE AND TELEGRAPH.

The principle of the telegraph was discovered by Prof. Joseph Henry, in 1829, and first practically applied by Morse in America and Wheatstone and Cook in England. The first telegraph line in America was erected between Baltimore and Washington in 1844, and the first message "What hath God wrought" is ever recalled with increasing force, as we contemplate the vast network of wire and cable that now forms the nervous system of the

commercial and political world. For a long time the simple Morse system of telegraphy was the only one in general use in America, and similarly the single needle system in England, but as these became inadequate to the volume of business requiring to be done, other and more rapid systems were developed.

The "duplex" system, by which two messages can be sent in opposite directions at the same time over the same wire, appeared in 1858, but did not come into general use until in the early seventies. Later, in 1878, Edison brought out his "quadruplex," by which four messages can be simultaneously transmitted over the same wire without interference. Of late, the Delaney "synchronous multiplex" has taken a prominent place, but without doubt the greatest advance that has been made for many years in land telegraphy has occurred in the past year, and is due to Prof. Henry A. Rowland, of Baltimore. He has brought out a "multiplex printing telegraph," by which sixteen messages per minute, of twenty words each, may be sent over a single wire by operators skilled only in the use of the typewriter, the messages being automatically recorded, not in cipher, but in ordinary type, at each end of the line. I had the pleasure of seeing his apparatus, which is a marvel of mechanical beauty, in successful operation a few weeks ago, over artificial lines varying from 500 to 1,000 miles in length. A modification of his system, adapted to automatic sending, will transmit from 3,000 to 4,000 words per minute. What this means may be seen by remembering that at this rate the contents of a New York daily might be transmitted to Montreal in less than an hour.

But, notwithstanding these devices, by which the carrying capacity of a single wire is multiplied many times, efforts are continually being made to do away with wires altogether, and to transmit messages by setting up electro-magnetic waves at different sending points, and using suitable detectors as receivers. At the transmitting station, by means of a key and suitable sending mechanism, a series of electro-magnetic waves are projected into space and travel in all directions with the speed of light. Falling upon a metallic collector connected to a tube containing fine conducting particles in loose contact, the particles are found to cohere and to have an increased electric conductivity. This change in their conductivity is readily used to register a signal. Other forms of detectors or receivers have also been devised, and some of you probably remember the beautiful magnetic detector invented by Prof. Rutherford, shown by him in the McDonald Physics Building some months ago.

Wireless, or space telegraphy, as it is sometimes called, though partially successful up to distances of about twenty miles, will not, in its present form, supersede the older methods. It is, however, finding a limited application in England, particularly in their coast signalling system, and Mr. W. H. Preece, in a recent address before the Institution of Civil Engineers, states that a system of his own is now in use by the Post Office and War Departments of the British Government.

The extent to which the telegraph in its ordinary form is used may be roughly gathered by recalling that in the United States there are more than a million miles of telegraph wire, strung on over 200,000 poles, and connected to about 25,000 offices. The number of messages annually transmitted by a single company has already reached some 70,000,000, resulting in a gross income of over $25,000,000.

The telegraph and cable systems of the British Empire employ, according to recent statistics, about the same length of wire, 1,111,000 miles, and transact a proportional business.

No great advance has been made in cable working since Lord Kelvin devised his mirror galvanometer and siphon recorder, except the application of duplex working, by which the capacity of cables has been practically doubled, but a great number of improvements in detail have been effected and many new cables laid, until now some 150,000 miles of ocean cable are in use, costing roughly about $150,000,000, and requiring a fleet of over twenty ocean-going vessels to keep them in repair.

Bell obtained his fundamental telephone patent in 1876, and a number of important improvements were made shortly after. The first Bell instrument was used both as a receiver and transmitter, but the carbon transmitter and induction coil made their appearance within the next year. Since then a vast amount of work has been done in perfecting details, and now telephonic communication is daily carried on between points from 1,000 to 1,800 miles apart with perfect clearness.

In the United States there are considerably over a million telephone instruments in daily use, and each day more than three million connections are made. In England about 150,000 miles of telephone wire are in use, and the number of messages per year has reached something over eighty million.

OTHER APPLICATIONS.

The most marked feature of electrical development in the past year has been the astonishing growth of the electric vehicle business. Within a few months, orders amounting to $15,000,000 have been received by American manufacturing companies from Europe, and it is expected that the entire cab system of Paris will substitute electricity as a motive power before the end of the present year. Cleanliness, increased speed, and the easing of the congested traffic conditions in our crowded business districts are obvious results, but I also look for the betterment of our country roads, even to a greater extent, from the use of the automobile than the bicycle. The old days of post roads and country inns will be revived, but electricity instead of horses will be the motive power. Indeed, a company has recently been organized in Paris to carry out this very idea.

The applications of electricity in electro-chemical processes and in the refining of metals is also most marked. In 1897 the output of German electrolytic alkali works alone was 20,000 tons, and in the past year it is estimated that more than 300,000,000 pounds of copper were electrolitically refined. Some 8,000,000 pounds of aluminum are also annually produced in the same manner, to say nothing of the various products of the electric furnace.

In hundreds of other ways electricity is playing a similar part. In agriculture, electrical methods of stimulating plant growth have passed the experimental stage. In medical practice it has become indispensable. In domestic life the electric call-bell, chafing dish and fan motor bring a measure of comfort even to bachelor quarters. Indeed, no bounds can be placed upon this spirit of the 19th century, that comes

"To answer our best pleasure ; be't to fly
To swim, to dive into the fire, to ride
On the curl'd clouds."

NOTES.

Last month it was stated that "things would soon quiet down with construction men, and supply dealers would be correspondingly affected." This is exactly the status of business at present in Montreal, with, however, every indication of a brisk spring trade at the opening of navigation.

The Laurie Engine Co., of this city, have just completed a new 500 h.p. engine for the Winnipeg Electric Street Railway. This engine is of the vertical cross-compound Corliss type, provided with tail rods and a shaft governor. The cylinders are respectively high pressure 18 inches, and low pressure 36 inches in diameter, with a common stroke of two feet. The fly wheel is ten feet in diameter and weighs about fifteen tons. The working steam pressure is to be 125 lbs. per square inch, and the speed 120 revolutions per minute.

The Lachine Rapids Hydraulic & Land Co., of Montreal, having suffered interruptions to their lines, engaged detectives to discover the miscreants. As a result a charge was laid against Alexander Daoust, under article 492 of the Criminal Code, for attempting to damage wires used for electric lighting. The manner in which the interruption was caused was by throwing iron hoops so that they would rest on both wires, thus producing a short-circuit. Daoust was tried before Judge Desnoyers, who imposed a fine of $5.00 and costs, serving to show that the law punishes any interference with electric wires.

The death is announced of Mr. F. H. Badger, jr., son of Mr. F. H. Badger, city electrician of Montreal, at 35 years of age, from pneumonia, brought on by an attack of la grippe. Deceased was for some time in charge of the contruction department of the Royal Electric Company, of this city, later taking charge of the lighting department as superintendent. He left the Royal Company some years ago to take charge of the Montmorency Power Company's plant at Quebec, succeeding the late Mr. Mohr. Lately Mr. Badger resigned his position with the Montmorency Power Company to accept a position in Washington, U.S.A.

Motor-vehicles as sold in the United States will be about as useful in the city of Montreal as a wheel-barrow. It would appear that the cities in the United States must be fairly level, judging by the grades which the auto-vehicles are guaranteed to ascend. As Canadians are beginning the manufacture of these popular articles, they will not be likely to forget Montreal, more especially if any of the members of their company have had occasion to walk up-town on a hot summer's day. If they have driven in Montreal, they will also remember that the rule of the road is 'to the right,' hence the controller handle would be of more use arranged 'right'-handed.

The upper pumping station of the Montreal waterworks is situated in rear of the McGill College grounds, near the main reservoir. The McGill authorities claim that smoke from the stack of the station damages their instruments. They also contend that leaks from the reservoir percolate down into their grounds and undermine the foundations of certain buildings, which seems quite probable, as it has been known for some time that the reservoir was defective. As a means of overcoming the smoke nuisance, the authorities of McGill have suggested that electricity be utilized for pumping purposes, the power to be obtained from the Lachine Company or the Royal Electric Company. They have offered to submit a scheme if remunerated for their work by the council. That any change will be made is extremely improbable, as the contract for a new boiler has recently been given to Mr. John McDougall.

SERIES ARC LIGHTING.*

By Wm. A. Turbayne, E.E.

Although the arc light first made its appearance about the beginning of the present century, it is only within the last quarter of a century that it has become generally adopted as an illuminant. About the year 1802, an Englishman, Sir Humphrey Davy, conceived the idea of opening an active electric circuit between two points of carbon. He had at his disposal some 2,000 cells of a simple primary battery, which he connected in series, and from the extreme terminals he brought wires to the ends of which were connected small pieces of charcoal. These he touched together and afterwards drew apart, and in so doing the current bridged the gap which was made, appearing as a flame having powerful heating properties and causing the charcoal tips to glow to an intense whiteness. Thus appeared the first true arc light.

The charcoal points were evidently held in a horizontal position, as the stream of vaporized carbon appeared in the form of an "arch," being impelled upwards in the centre by the ascending currents of air; from this phenomenon we derive the name "arc" light. About thirty years after this discovery of Davy's, one Michael Faraday discovered and promulgated the principle of electro-magnetic induction. He found that when a steel bar magnet was passed through a coil of wire properly arranged, a current of electricity was momentarily induced in the coil, which manifested itself similarly as the current from a primary battery, and this important discovery soon led to the development of the dynamo machine for producing powerful currents.

Previous to the introduction of these dynamos the arc light was seldom seen outside the laboratory, the expense and annoyance, coupled with the use of acid batteries, prohibiting its more extended adoption. With the advent of the dynamo, however, renewed interest was taken in the development of the arc light; mechanisms called lamps were devised for feeding the carbons together as they wasted away, and improvements were introduced into the current generators so that an uninterrupted light could be maintained for considerable periods. Even at this time, however, the usefulness of the new light was limited, as it was found that the feeding of the lamp so affected the current in the line that only one lamp could be operated on a single circuit, and it was only in certain isolated cases, such as in lighthouses, that the light became of value.

This was the condition of affairs until some forty years later, when in 1875 Chas. F. Brush, of Cleveland, and others, discovered the principle of differential regulation, which made the operation of several lamps on one circuit and machine possible, and made each lamp an independent unit as regards its feeding properties.

It is not our intention in this paper to follow the art of arc lighting from the date of its inception and to successively note the advances which have been made in bringing this method of illumination up to its present state, but to offer a brief exposition of the cardinal principles involved, and to shortly describe the functions of the mechanisms employed in a modern system of series arc lighting, in which a direct current of constant value is employed, a system which has been developed since the introduction of the differential lamp of 1875.

Such a system virtually comprises a current generator or dynamo, a number of arc lamps and an arrangement of conductors interconnecting the whole in such manner that the current on leaving the dynamo enters the first lamp and thence passes to the next, and after having successively traversed all the lamps in like order, returns to the dynamo, the path of the current therefore being in one continuous circuit, within which the total electrical energy produced by the generator is expended.

If we take a pair of carbon rods and introduce them into an active electric circuit, as above, no light will be emitted until a separation of the carbons takes place, and we find that, with the current strengths adopted in practice, a separation of approximately one-eighth of an inch gives the best results, as being free from objectionable hissing or flaming. Such an arc requires for its maintenance an electro-motive force or pressure of about 45 volts, which represents an energy of something over ½ horse power. This energy is expended, in part, in overcoming the resistance of the arc gap, but the greater part appears in the form of heat, and the resulting temperature is so concentrated and intense as to cause a vaporization at the surface of the positive carbon, which in the process is brought up to a highly incandescent state, this being in reality the source of light. This vaporization and a combustion of the carbons is accompanied by a gradual wasting away and consequent shortening of same, and in order, therefore, to maintain an uninterrupted light, means must be found for feeding the carbons together at a rate proportional to this consumption.

An arc lamp, therefore, is substantially a mechanism for initially separating the carbons a predetermined distance, and for further maintaining them at this distance during continued operation. In studying the arc lamp we will not touch on the innumerable mechanical devices, such as racks and pinions, brake wheels, clutches and bands or chains, which are employed with the one view of gripping and releasing the carbon under the control of the actuating magnets, but we will describe the action of an ideal differential lamp, such, in fact, as may be taken as a representative of the types in extended use.

The carbons are separated by an electro-magnet in the main circuit through which the whole current passes, while the feeding is effected by another electro-magnet acting in opposition to and tending to overcome the lifting action of the first. The second magnet is provided with a high resistance winding of fine wire and is connected as a shunt across the carbons, and therefore exerts a greater or lesser influence, accordingly as the carbons are more or less widely separated; therefore, as the carbons are consumed the arc increases in length, and coincidently the second magnet opposes the action of the first, until finally it overpowers it and allows the carbons to feed forward. In practice so fine a balance is obtained between these two magnets that the carbons are continually feeding forward in imperceptible degrees.

There are, of course, numerous modifications of this principle introduced into different lamps, but, nevertheless, their electrical actions are similar, inasmuch as the separation of the carbons is brought about by the action of the main current itself, while the feeding is accomplished by the action of a circuit derived from this and having as terminals the upper and lower carbons.

We may here state that the illuminating power of an arc lamp varies with the electrical power which is expended within it. This electric power, expressed in watts, is the product of two factors—the electro-motive force or pressure and the volume of the current as expressed in the terms volts and amperes respectively.

We have seen that the function of the arc lamp is to look after one factor, viz., the pressure or volts across its terminals; consequently, in order to produce an unvarying light, we must keep the other factor of current volume constant.

The functions, therefore, of the generator or dynamo is to furnish a current of constant strength, and, as the lamps are connected in series, and as each demands some 45 volts as explained, it must operate at a pressure sufficient to maintain the number of lamps for which it was designed to operate, together with sufficient marginal pressure to overcome the resistance of the copper lines connecting same.

An arc lighting dynamo, like most other dynamos, consists essentially of an arrangement of copper conductors wound over an iron core and rotating within the influence of the poles of a powerful electro-magnet, but, as contrasted with constant pressure dynamos, which include those used in operating incandescent lamps in multiple and those used in furnishing current to stationary and street railway motors, it must possess peculiar

* Paper read before the Hamilton branch Canadian Association Stationery Engineers.

properties, which are required to adapt it to the running of arc lamps on series, and notable among which is that a fall of current below the normal strength must be accompanied instantly by a rise in voltage, and likewise with an increase of current the voltage must fall. We may here state that while the function of a constant pressure dynamo is to keep the electro-motive force or pressure factor constant while the current is variable, the constant current or arc dynamo, on the other hand, must keep the current factor constant while the pressure is variable. In such a machine the magnets are series wound, and the energizing windings are traversed by the full current passing through the circuit of lamps. The iron magnet cores are so proportioned as to be magnetically saturated, that is, are worked to such a high degree of magnetization as to be insensible to slight changes in the strength of the current which energizes them.

On the other hand, the rotating armature is wound with a great number of turns of wire, and in reality constitutes a powerful magnet, which is sensitive to current changes, and which meanwhile reacts against and partially controls the magnetic field, which induces the current within itself.

As, therefore, the switching off of a lamp, or the feeding of several lamps at once, would cause the current to rise, the armature magnetization would increase perceptibly, while that of the field magnet would not do so; the former would, therefore, so react against the latter as to reduce the effective magnetic strength, and the voltage therefore would fall; the reverse action would likewise take place should one or more lamps be switched on. In order that this inherent regulating property will be effective over the whole range of the machine, automatic current regulators are employed, which, by moving the collecting brushes around the commutator, or by adjusting the field strength, so adjust the electro-motive force, and incidentally the current strength, as to meet the conditions of the outside load, and further assures sparkless operation at the collecting brushes.

The power required to drive an arc dynamo will be in proportion to the number of lamps burning at any time, and will vary as the number of lamps in operation. As we have stated that the electric power is the product of the current volume and the electro-motive force, and as the former factor is constant, the power delivered will vary, therefore, as the latter factor, which varies only as lamps are added to or withdrawn from the circuit.

Arc dynamos, unlike constant pressure dynamos, do not necessarily demand the refinements in speed governing in the mover which drives them, as the inherent regulation of the machine itself will look after any such irregularities as are met with in practice; and in fact, with the brushes locked in a fixed position, constancy of current during change of load may be obtained by varying the running speed only.

There are other accessories, such as automatic lamp cut-outs, which ensure continuity of the circuit should a lamp be defective, lightning arresters for protecting the lines and station apparatus, and loop switches for controlling groups of lamps, which we cannot now cover in detail, and which, although essential to the satisfactory and safe operation of such a system, yet are not necessary to the production of the light itself, the generator and lamps being the indispensable adjuncts of a series arc lighting system.

MARITIME ELECTRICAL ASSOCIATION.

Arrangements are being completed for the next convention of the Maritime Electrical Association, which will be held in the city of Halifax, N.S., probably about the 18th of April. Further particulars will be given in the next issue of the ELECTRICAL NEWS.

Mr. J. E. Askwith, of Ottawa, is endeavoring to organize a company, to be called the Compressed Air Transmission Company of Ottawa, for the purpose of transmitting and supplying compressed air in the city of Ottawa and elsewhere.

SPARKS.

Mr. W. J. Fletcher, of Markham, Ont., has disposed of his electric light plant to the corporation.

It is again reported that the Galt and Hespeler Street Railway will be extended from Preston to Berlin.

The Board of Police Commissioners of Toronto have decided to test an ambulance propelled by electric power.

The Ontario Legislature has granted authority to the London Electric Company, Limited, of London, Ont., to increase its capital stock to $500,000.

Mr. C. A. Chant, B.A., lecturer on Physics at Toronto University, recently delivered a public lecture, with demonstrations, on "Electric Waves.

The annual meeting of The Canadian General Electric Company was held in Toronto recently. All the old directors who were eligible were re-elected.

The electric light plant at Shubenacadie, N.S., has changed hands. It has been purchased from its former owner, R. C. Ervin, by John Christie, of Dartmouth.

The Ottawa Suburban Electric Company, of which Mr. Geo. E. Kidd is solicitor, is asking for a charter to build an electric railway to Shead's Mills and Windermere.

Messrs. Cunliffe & Ablett, of Rossland, B. C., have placed an order with the Canadian General Electric Company for two of their standard 50 h.p. three phase induction motors.

The Department of Railways and Canals has purchased from the Canadian General Electric Company additional generating apparatus for their improvements on the Sault canal at Sault Ste. Marie, Ont.

The Private Bills Committee of the Ontario Legislature has passed the bill authorizing the town of Goderich, Ont., to issue $25,000 of debentures to complete the water works and electric light plant.

The annual meeting of the Guelph Light & Power Company was held recently, at which Mr. D. Guthrie was re-elected president, Mr. Richard Mitchell vice-president, and Mr. John Yule general-manager.

The annual statement of the Halifax Electric Railway shows that the gross earnings in 1898 were $197,830, an increase of $4,450. The operating expenses were $113,081, against $112,570, an increase of $511.

The city council of Montreal have accepted the tender of John Macdougall, of the Caledonian Iron Works, for furnishing a boiler for the water works, at the price of $5,975. Other tenderers were: Geo. Brush, $5,680; Babcock & Wilcox Co., $6,410.

The town council of Pembroke, Ont., and the Pembroke Electric Light Company have not reached an agreement regarding electric lighting, and it is possible that a by-law may yet be submitted to the ratepayers to raise money to install a municipal plant.

The Light, Heat & Power Co., of Lindsay, Ont., is making some extensive additions to their power plant, and have purchased a large 500 volt multipolar power generator from the Canadian General Electric Company for the purpose of meeting the many demands for power.

The Richelieu & Ontario Navigation Company are equipping their new boats in the most modern manner, and have purchased from the Canadian General Electric Company two of their standard direct connected 500 light generators, with Ideal engines and marble switchboards.

The city of Sherbrooke, Que., recently invited tenders for electric lighting, and has awarded the contract for five years to the Sherbrooke Gas & Water Company. The price for arc lamps, 7½ amperes, is $60 per lamp up to 100, and $50 per lamp for all over that number, four incandescent lamps to count as one arc lamp.

The annual meeting of the Cataract Power Company of Hamilton was held last month, at which the following officers were re-elected: President, Hon. J. M. Gibson; vice-president, James Dixon; treasurer, John Moodie; secretary, John Patterson. The company is now delivering 1,000 h.p. in Hamilton, and contracts are about to be closed which will double that amount.

As examples of unsuccessful municipal plants, it is pointed out that Xenia, O., paid $35,000 for its lighting plant, and sold it for $10,060, and made a contract with a private company; Gravesend, L.I., paid $120,000 for its plant, sold it for $30,000, and made a contract with a private company also; Grenville, S. C., found it could better afford to pay a private company $100 a light than to own its own plant.

The town council of Gravenhurst, Ont., is considering a proposition to raise $20,000 for a waterworks system and $10,000 for an electric lighting plant, and in response to a request, Orillia town council has offered to supply Gravenhurst with 100 horse power for the sum of $1,000 per year, the former municipality to pay the cost of line construction to Ragged Rapids, about ten miles distant. This price is for power delivered at Ragged Rapids.

The British Columbia Electric Railways Co., Vancouver, B.C., are making vast improvements in their railway development, and for the purpose of carrying out this work have purchased from the Canadian General Electric Company three C.G.E. 1,000 two-motor equipments, and four C.G.E. four-motor equipments, complete with controllers, resistances, etc. They have also, for their lighting plant, placed an order for a large 500 kilowatt alternator of the Canadian General Electric Company's type.

SPARKS.

Joseph Knox, Esq., of Stayner, has purchased from the Canadian General Electric Company a 700 light single phase alternating current dynamo.

The railway commissioners of the town of Port Arthur, Ont., have purchased a new Goldie & McCulloch boiler, for operating the electric railway.

Mr. Thos. Tompkins, of Brockville, Ont., has had plans prepared for a new hotel to be erected in that town, and which will be equipped with an electric light plant.

The Montreal Novely Co. are lighting their factories at Louiseville, P.Q., and have just installed an electric plant for this purpose, purchased from the Canadian General Electric Company.

The city council of Winnipeg seems to be in favor of a civic electric lighting plant, and it is probable that the question will again be submitted to the ratepayers, notwithstanding that it was defeated a few months ago.

A dispatch from Buffalo states that the Niagara Falls and Lewiston railroad, otherwise known as the Gorge Road, has passed into the hands of a receiver. This is said to be due to the heavy losses from damage suits.

The town of Brockville, Ont., is considering the question of installing a municipal electric light plant. It is not expected that any definite action will be taken during the present year beyond obtaining estimates of the probable cost.

The Alberta Railway & Coal Co., of Lethbridge, N.W.T., is installing an electric outfit, and has purchased from the Canadian General Electric Company a 150 light direct current generator, with the necessary supplies, for lighting their mines.

Mr. John Mullin, formerly connected with the Ottawa Electric Railway Company, is now in Port Elizabeth, South Africa, where he is inaugurating a new road under the auspices of the British Canadian Electric Company, of London, Eng.

The Guelph Street Railway Co. have recently purchased from the Canadian General Electric Company one of their standard 110 kilowatt 6 pole railway generators. This has been installed, and is said to be much admired by all who visit the power house.

The town of Whitby, Ont., is about to make arrangements for its electric lighting. It is reported that a contract for five years with Madill Bros. will be recommended by the Fire and Light Committee.

The Canadian General Electric Company have closed a contract with the London Electric Co. for one of their standard 300 kilowatt revolving field type single phase generators, which is the second machine of this type recently purchased by the London company.

This is not the season for mosquitoes, but an inventor of Angouleme, France, is ready to welcome them with a novel thrill. He has invented a mosquito netting, which is charged with electricity, and the moment an insect touches it down the insect drops, shocked to death. Next !

The Canadian General Electric Company have received an order from the Toronto Railway Co. for a third large generator ; this will be of the direct connected type, similar to the two already in operation, and will have a capacity of 850 kilowatts, operating at 85 revolutions per minute.

It is announced that a Toronto syndicate have instructed Messrs. Bond & Smith, architects, to prepare plans for a large office building to be erected on Terauley street, opposite the new city hall. The building will contain a private telephone system, and will be equipped with an electric lighting plant.

The Lake Erie and Detroit River Railway, of Walkerville, Ont., are equipping their magnificent steamer "Flora" electrically, and have contracted with the Canadian General Electric Company for a lighting generator, in connection with an Ideal engine, marble panels, and the wiring of the steamer throughout.

The various local associations of marine engineers in Canada have decided to amalgamate, under the name of the National Association of Canadian Marine Engineers. This step was decided upon at a meeting held in Toronto on March 9th. The first convention will be held in Montreal shortly after the close of navigation.

Mr. A. A. Dion recently delivered a public lecture in Ottawa on "Electricity as Applied to Arc and Incandescent Lighting." Mr. Dion showed how electricity was generated in a dynamo and how transformed in distribution by means of transformers, and explained the construction and operation of arc and incandescent lights.

The Montreal Street Railway Company are now testing a street car recorder, similar in principle to the ticker used in the brokers' offices to record the fluctuations of the stock market. By attaching the instrument to any line a record is shown at the superintendent's office, and it can then be seen how many cars pass a given point in a given time.

The Peterborough Light & Power Company have submitted to the Council of Ashburnham, Ont., a proposition for lighting the village, in which they agree to furnish power and light for the eleven arc lights now in use for a term of five years at the price of $50 each per year, burning from half an hour before dark till midnight for at least three hundred nights a year.

A bill to incorporate the Nova Scotia Electric Light and Heat Company has passed the legislature of that province. The company propose to light by electricity the whole Annapolis valley from a power station to be situated on the Gaspereau river. The estimated expenditure is placed at $400,000. The incorporators are : Dr. F. W. Borden, Minister of Militia, Ottawa ; Dr. Allen Haley, M.P., Windsor, N.S.; J. W. Beckwith, C. O. Ross, F. W. Clarke and F. B. Wade, of Bridgewater, N.S.

The Kentville Electric Light & Power Co., Kentville, N.S., find that the demands upon them for light and power have been so great during the past year that they have been compelled to increase their capacity, and for this purpose have purchased two-45 kilowatt direct current generators from the Canadian General Electric Company, of their latest multipolar type.

The Quebec District Railway, Light & Power Company will this spring build a new line of railway to connect with the old Quebec, Montmorency & Charlevois route at Montmorency Falls. When the system of this company is completed about 60 miles of electric road will be in operation. New cars for the company are now under construction by the Ottawa Car Company.

A. S. Bowen, Esq., of the Kemptville Milling Co., Kemptville, Ont., has purchased the plant of the Kemptville Electric Light Co., and is making some material changes in modernizing the apparatus. For carrying out this work, he has purchased from the Canadian General Electric Company one of their standard new type 60 kilowatt single phase alternators, with necessary switchboard and instruments.

The town council of Picton, Ont., has engaged Mr. Roderick J. Parke, E.E., of Toronto, to prepare plans and specifications for improvements and extensions to the municipal electric lighting plant. Tenders for an alternator of 120 kilowatts capacity, transformers of a total capacity of 1,000 lights, slow speed engine of 125 h.p., and general supplies, such as weatherproof wire, insulators, cross arms, etc., are invited up to April 4th.

The corporation of the town of Barrie advertised for tenders for alternating current apparatus. The contract for 120 k.w. "S.K.C." two phase alternating current generator for power and lighting apparatus was awarded to the Royal Electric Company, of Montreal. The entire lighting and steam plant, which has been taken over by the corporation from the Barrie Gas & Electric Company, is being rebuilt and the capacity enlarged.

The Edison Electric Light & Power Co., of Springhill, N.S., are about to undertake the developmeut of a water power, and invite tenders up to March 31st for the supply of generators, switchboard equipment, transmission line, extension of line in new district, wiring and necessary material for three thousand house lights, hydraulic machinery, and the construction of power house. The generators are to consist of two alternators of 75 k.w. each, with sufficient transformers. The president of the company is Mr. J. E. Simpson.

The Canadian General Electric Company have received an order from the T. Eaton Co. for one of their standard 130 kilowatt direct connected generators. This makes the fourth generator of this size which the T. Eaton Co. have purchased from the Canadian General Electric Company, in addition to one 75 kilowatt and one 25 kilowatt generator of the same type. The T. Eaton Co. are furnishing power from their electrical apparatus for operating all their manufacturing machinery and the lighting throughout the whole of their premises. The plant when finally completed will be the largest and most modern isolated plant in Canada.

It is reported in Buffalo that a deal has been consummated for the purchase by a New York and Philadelphia syndicate of the entire street railroad system of Buffalo and a number of suburban lines. The companies involved are given as : The Buffalo Railway Company, the Buffalo Traction Company, the Buffalo, Bellevue & Lancaster Railway Company, the Buffalo & Niagara Falls Railway Company, the Buffalo and Lockport Railway Company, the Niagara Falls Park and River Electric Railway Company (running along the river bank on the Canadian side), the Niagara Falls and Clifton Bridge Company, and the Lewiston & Queenston Heights Bridge Company. The capital of the syndicate is estimated at $25,000,000.

Mr. John R. Booth, of Ottawa, has entered into a contract with the Canadian General Electric Company for a large power transmission plant to be used in connection with railway shops at Ottawa. The power will be transmitted a distance of from three to four miles, at a pressure of 4,000 volts. The generating plant will consist of two 150 kilowatt revolving field three phase generators, together with the multipolar exciters and marble panels, with latest type instruments. At the receiving end for operation of the different departments, there will be installed three 100 kilowatt revolving field type 4000 volt three phase synchronous motors. The plant when completed will be a model in every particular, and Mr. Booth deserves admiration for being one of the first to recognize the advantages to be derived from a power transmission of this kind, where the power to be transmitted will be wholly for his own use.

A syndicate of Toronto capitalists, headed by Mr. J. A. Culverwell, electrical and mechanical financial broker, is reported to have purchased the Burleigh Falls water power, near Peterboro'. The purpose is to develop the power and transmit it to Peterboro' and Lindsay, twenty and thirty miles distant respectively. There is a head of twenty-five feet, and an estimated power of between three and five hundred horse power. The dam and power house will be located at the foot of Perry's Creek, at a point where the channel is so narrow that a concrete dam for the purpose can be built at a cost of about $5,000. The government canal dam will take the overflow of the spring freshets, while it is said that the peculiar situation removes all possible danger of interruption from anchor or frazil ice. At Lindsay Mr. Culverwell has secured the town lighting contract for ten years, and revenue for power and lighting amounting to some $15,000 per annum. The company will be capitalized at $200,000.

CONSOLIDATION OF ELECTRIC MANUFACTURING INTERESTS IN TORONTO.

The amalgamation has taken place since our last issue of the W. A. Johnson Electric Company and the Toronto Electric Motor Company, Limited, of Toronto. About one year ago the business of the Toronto Electric Motor Company was reorganized as a joint stock company, Mr. J. W. Thompson at that time purchasing an interest and combining with it the manufacturing business formerly carried on in Hamilton under the style of the Thompson Electric Company. Recently Mr. Thompson secured control of the entire business of the Toronto Electric Motor Company, and now this company and the W. A. Johnson Electric Company have amalgamated their manufacturing business under the style of the United Electric Company, Limited, with head offices at 134 King Street west, Toronto. Both factories will be operated at present, and arrangements are being made for a considerable extension of their manufacturing plants.

The officers of the new company are as follows: W. A. Johnson, president; J. W. Thompson, secretary and treasurer; J. Norman Smith, engineer in charge of works. The official staff of the company have had a long and extensive experience in electrical engineering and manufacturing, and being practical and technical experts, the success of the new company would seem to be assured. Mr. Johnson has since 1882 acted in the capacity as superintendent and electrical engineer, and for many years general manager of the Ball Electric Light Company, Limited, the first electrical manufacturing business established in Canada, and for the last five years proprietor of the manufacturing business of the W. A. Johnson Electric Company. Mr. Thompson was also on the staff of the Ball Company, and later had entire management of the Reliance Electric Mfg. Company. Mr. J. Norman Smith was formerly superintendent of the Ball Company, and for the past five years engineer for the W. A. Johnson Electric Company.

The United Electric Company will have a capital stock of $150,000, of which $100,000 is fully paid in, and $50,000 treasury stock. The company will manufacture a very complete line of apparatus, including automatic arc dynamos and universal arc lamps of enclosed and open types, direct driven and belted direct current multipolar dynamos and motors, bipolar motors and dynamos, inductor alternators (having inherent regulation) for lighting and long distance power transmission by polyphase currents, induction motors, etc. To these other lines will be added not heretofore manufactured by the respective companies in the consolidation. The Toronto Electric Motor Company have done a large Canadian business in bi-polar direct current motors of the single-field coil type.

The various agencies of both companies will be maintained and agents will be appointed where neither company is now represented. With the enlarged facilities for doing business, the company will be in a position to cater for all classes of electrical work.

A manager is wanted for the St. Thomas Street Railway. Applications are to be made to the president, Mr. J. H. Still.

The Bear River Electric Light Company, of Bear River, N.S., have decided to extend their system to Digby, which will necessitate increased equipment.

Messrs. Darling Bros., of Montreal, have just issued a new catalogue describing some of the special machines which they manufacture, and for which they are sole agents in Canada. These include, among others, the Webster vacuum feed water heater, the Moore steam pump, the Morse valve reseating machine, and the Nordberg governor.

SPARKS.

Messrs. Brown & Boggs, manufacturers, of Hamilton Ont., have decided to operate their factory by electric power, and are installing a 30-h.p. two phase "S. K. C." motor. Power for the same will be furnished by the Cataract Power Company.

The Brantford Gas Company, of Brantford, Ont., has a bill before the Ontario Legislature providing for an increase of capital stock to $200,000. It is understood that the company have in view an amalgamation with one of the local electric light companies.

The Canadian Development Company, of Victoria, B. C., have been building a steamer on Lake Bennett, Yukon Territory, and expect to have it ready for its trial trip by April 1st. The boat is lighted throughout by electricity; the plant being furnised by the Royal Electric Company, of Montreal, and consisting of one of their C. W. multipolar dynamos, direct connected to a horizontal ideal engine, this making a very compact and complete plant.

The Winnipeg Street Railway Company have been supplying the electric light and motor services from the same wires, but finding their capacity inadequate, announced their intention of changing the system and substituting new motors, placing the whole service in a more satisfactory condition. The cost of new motors was given as follows: 1-½ h.p. motor, $30; 2 h.p $35; 3 h.p. $42.50; 4 h.p. $50; 5 h.p. $60; 6 h.p. $70; 10 h.p. $80; 12 h.p. $100. Their customers, however, have not taken kindly to the proposal, and at a recent meeting passed a resolution against any change being made.

The Metropolitan Railway Company will erect a supplementary power house at York Mills to assist the generation at the large station at Bond's Lake. Concerning the improvements now being made by the company, the consulting engineer, Mr. W. T. Jennings, says: "Considerable additions are being made to the rolling stock. Although the company has the right to use steam, it will depend entirely upon electric power. The dynamos, the motors, and the rest of the machinery will be first-class in every particular. A special class of heavily equipped freight cars will be used, suitable not only for carrying very considerable loads themselves, but also for drawing other loads. If business warrants it, an electric locomotive of orthodox type will be purchased. These locomotives are of the Baldwin-Westinghouse pattern, are capable of drawing immense loads, and weigh from 22 to 25 tons. The passenger cars will be of the latest and best description, and of the style most suitable for the business of the Metropolitan Railway. The intention is to make the road first-class throughout for both passenger and freight business. It is possible that connections with the Grand Trunk Railway at Newmarket or Aurora and with the Canadian Pacific Railway at North Toronto will be made, but this will depend upon the probable results.

PERSONAL.

Mr. Geo. White Fraser, of Toronto, has been appointed by the Dominion Government to survey the boundary between British Columbia and the Yukon district.

Mr. Geo. Morrison, at one time a well-known manufacturer of engines and boilers in Hamilton, died in that city last month. Some years ago he was associated with Mr. J. H. Killey.

Mr. J. C. McLachlan, who recently disposed of his interest in the Toronto Electric Motor Company, is reported as having decided to engage in the manufacture of gasoline apparatus for horseless carriages.

TRADE NOTES.

Mr. H. D. Symmes, of St. Catharines, has recently installed one of the Royal Electric Company's 35 light, four pole, direct current dynamos.

The Canadian General Electric Company have received an order from the Montreal Street Railway Co. for ten G.E. 1,000 two-motor equipments.

The Canadian General Electric Company have just received an order from the University of New Brunswick for a direct current lighting generator and motors.

The McPherson Shoe Company, of Hamilton, are installing in their works one of the Royal Electric Company's 50 h.p. "S.K.C." two phase motors. This is to replace their present steam plant.

A. W. Hepburn, of Picton, is fitting out his steamer with electricity. The order for a 12½ k.w. generator has been placed with the Royal Electric Company, and is to be installed at once.

The Montreal Cotton Co., of Valleyfield, Que., have just placed an order with the Canadian General Electric Company for three additional induction motors of 10 h.p., 50 h.p. and 75 h.p. respectively.

The Eagle knitting mills of Hamilton, Ont., are now operating their factories throughout by electricity. They have installed one of the Royal Electric Company's 40 h.p. "S.K.C." two phase motors, and have found the result very satisfactory, the power being very steady and the minimum attention required.

The Port Perry Electric Light & Power Co. have given the Royal Electric Company an order for one of their 2½ k.w. four pole exciters, to replace the exciter at present installed there.

The Hawthorn woollen mills, of Carleton Place, Ontario, are increasing their incandescent lighting plant, and have placed an order for a 200 light machine with the Royal Electric Company of Montreal.

The Royal Electric Company of Montreal have just completed the installation of a 100 h.p. "S.K.C." synchronous motor in the Iron Mask mine at Rossland, B. C., to operate the hoisting machinery and air compressors.

The Eclipse Whitewear Company of Toronto have been changing their motive power and increasing their factory. They have placed their order with the Royal Electric Company for one of their 10 k.w. four pole 250 volt motors.

The Penman Mfg. Co., of Paris, Ont., have purchased a 150 light direct current generator from the Canadian General Electric Company for the purpose of lighting their new factory at Paris. The contract includes the wiring installation as well.

The Kootenay Standard Publishing Company, of Rossland, B. C. are having placed in their printing house one of the Royal Electric Company's "S.K.C." induction motors to operate their printing presses, the power being furnished from the Kooteney long distance line.

Messrs. Lawry Sons, & Co. of Hamilton, pork packers, are changing from steam to electricity for power, and have placed an order with the Royal Electric Company for a 30 h.p. two phase "S.K.C." induction motor. They are also lighting their factory throughout by electricity.

An advertisement in the ELECTRICAL NEWS brings prompt returns.

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Montmagny Electric Light Co., Montmagny, Que.	1-35 in., " "
Sherbrooke Gas & Water Co., Sherbrooke, Que.	2-40 in., " "
Lake Weedon Electric Light Co., Lake Weedon, Que.	1-15 in., " "
Stanbridge, East, Que., Stanbridge, Que.,	1-25 in., Vertical Setting.
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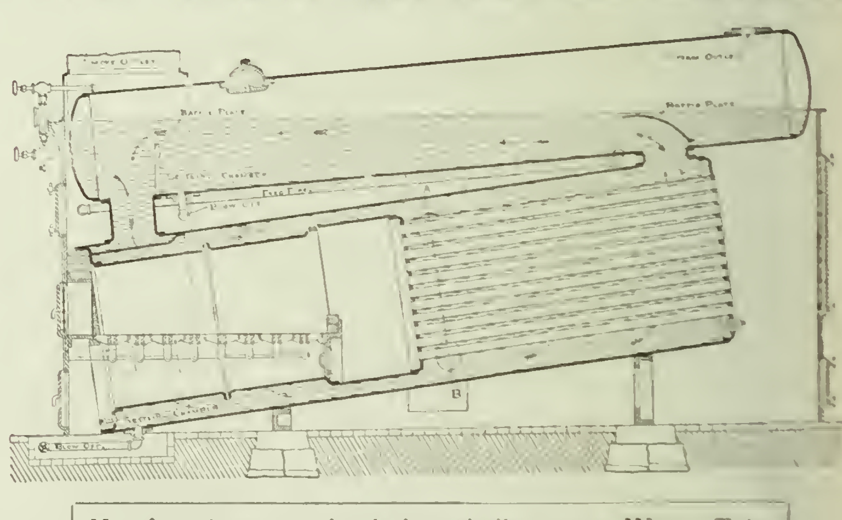

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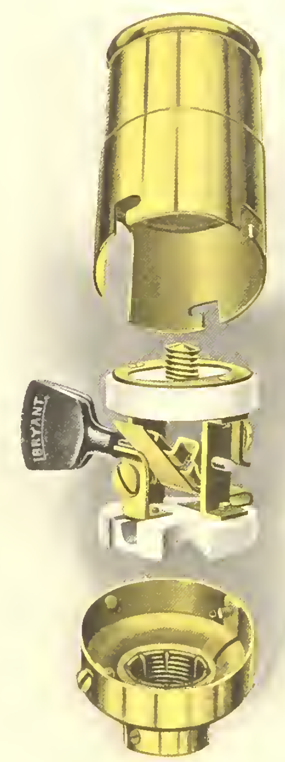
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CANADIAN
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STEAM ENGINEERING JOURNAL.

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THAWING OF WATER PIPES BY ELECTRICITY.

A number of successful experiments have recently been made in Canada and the United States with the use of electricity for thawing out frozen water pipes. The Canadian experiments were made in Ottawa, Berlin and Chatham. Below are printed particulars of the methods pursued in the above mentioned cities, together with illustrations showing the apparatus employed :

The Berlin Gas and Electric Co. used alternating current of 2,080 volts primary and 104 volts secondary ; this was further reduced by means of a water rheostat as described below to 50 volts. The apparatus, as shown in accompanying cut, consists of a large 200 light (40 G. S.K.C.) transformer, switchboard, several switches, C.G. watt meter to measure the current, all of which is placed on a small waggon for convenience in transportation, and a water rheostat. The water rheostat consists of the most simple type, a copper plate placed in the bottom of a wooden pail, another copper plate placed some 6″ to 8″ above the first and so arranged that it can be moved up and down as found necessary. There is enough water poured into the pail to well cover both plates. When in use the water is kept from boiling by the addition of snow or ice.

Apparatus for Thawing out Water Pipes.

The waggon is placed as near as possible to the place of operation. The wires of the primary circuit are brought to a D.P. switch on waggon switchboard, are then taken to the transformer, and back to a second D.P. switch on switchboard. The current is then conducted by two No. 6 wires to afford ample capacity for current without heating the wires and by means of a simple clamp these wires are attached to one end of frozen pipe. The second wire from the switch is then taken to the watt meter then by means of two No. 6 wires, is connected to lower plate in water rheostat. The wires from the top plate in the water rheostat are so connected to the other end of the frozen pipe that the frozen part remains between the terminals of the secondaries. A volt meter should be inserted in circuit after leaving the rheostat, and the rheostat so adjusted that the current will be reduced to 50 volts. In ordinary sizes of black or galvanized iron pipe the voltage should not exceed 50 volts. For from 4″ to 6″ cast iron pipes the pressure may be increased to 100 volts. In any case a strong ampere current should be used. The current in then turned on and carefully manipulated.

Only a very few moments are necessary ordinarily to thaw out water service pipes. The connections are made at any most convenient point where the pipe is exposed, a city hydrant, private pipe, or faucet in dwelling may be used.

It is necessary to use a source of current which does not affect the electric light lines by the grounding effected through connecting with the pipe, or danger may result.

In using this method to thaw the frozen condensation found in gas pipes the experience was that the thawing process had to be continued for a longer period of time.

Mr. John Murphy, superintendent of power houses, and Mr. W. G. Bradley, superintendent of construction for the Ottawa Electric Company, along with a representative of the City Engineer, conducted the experiments in Ottawa. Two Packard transformers, type F, made for 1,000 and 2,000 volts on the primaries, ratio of transformation of one to twenty, 125 cycles, were mounted on a sleigh and driven around where required. It was usually drawn up to the foot of the pole and primary wires carrying about 1,000 volts were brought down to the transformers by means of flexible wires. The transformers were worked in parallel and had the connections so made as to obtain a ratio of transformation of forty to one so that about 25 volts were obtained on the secondary. With this arrangement it was found possible to do without the reactive coil and other means of regulation which had been used in the first trials, so that the pipe-thawing outfit consisted simply of the two transformers above referred to and an ampere meter which was inserted on the primary, their being no portable instrument with large enough range to put on

the secondary ; a voltmeter was connected across the secondary coils.

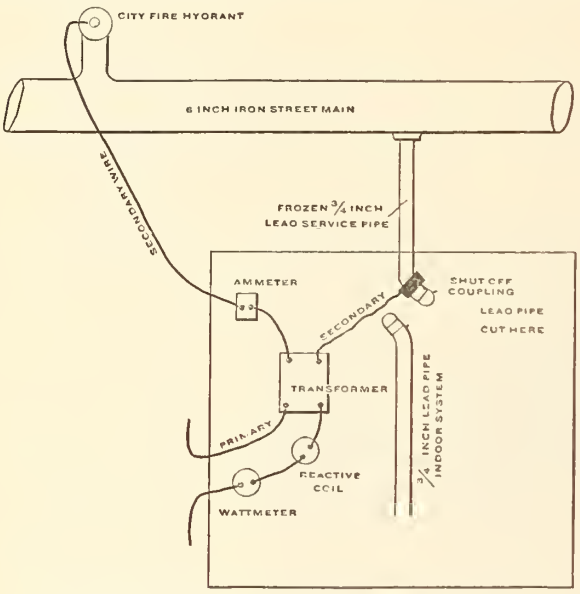
Following is the data of five trials which were made :

1st. Secondary volts 17, primary amperes 8. Connections made from water pipe 25 feet of ⅝" lead pipe to a hydrant at the door. Water flowed in three minutes and came out at full pressure in six minutes.

2nd. Secondary volts 21, primary amperes 5. Connections from water pipe in one house through about 100 feet ⅝" lead pipe and 16 feet 5" iron pipe to water tap in next house. One of the services only was frozen. Water flowed in eight minutes and with full pressure in ten minutes.

3rd. Secondary volts 22, primary amperes 9. Connections made to water tap inside and to iron main pipe in the street, which was reached by opening a man hole. Current passed through 25 feet ⅝" lead and 4 feet of 5" iron main. Water flowed freely in two minutes.

4th. Secondary volts 23, primary amperes 7. Connections made from water tap in one house through about 60 feet ⅝" lead and 24 feet of 5" iron pipe to the



Apparatus for Thawing out Water Pipes.

water taps in the next house. Water flowed in one minute and full pressure was on in 3 minutes.

5th. A lead pipe service between a residence and a stable being frozen, connection was made between the water taps in each place and water flowed freely in one minute. No reading of current was taken in this last case.

By the time the pipes completely thawed out the water in some parts of them had become very hot. In some cases it was found impossible to get any current through at all. This was due to the style of joints made in some of the main iron pipes where there was no electrical contact between the different lengths.

The experiment at Chatham, which was also entirely successful, was conducted by Mr. Jones, Superintendent of Waterworks, by the aid of current and a transformer of 100 amperes capacity supplied by the Gas and Electric Co. Using a current of 52 volts, two frozen hydrants were thawed in 45 minutes.

From Germany comes another invention in the domain of electricity, says the Engineering Magazine, in the form of a remarkable current-interrupter, utilising a hitherto unappreciated fact in electrolysis, and this invention of Professor Wehnelt bids fair to effect a great increase in the capacity of induction coils, and in the generation of currents available for advanced researches in radiography.

CANADIAN ELECTRICAL ASSOCIATION.

A well attended meeting of the Executive Committee was held on March 23rd. A number of persons were elected to membership in the Association. The arrangements for the annual convention to be held in Hamilton in June were considered, and committees appointed to carry the same into effect. The exact date of the convention was left undecided, pending more definite information on the subject of transportation rates. The representatives of the various electrical companies of Hamilton are taking an active interest in the arrangements, and there is no cause to doubt that the convention this year wil be as interesting, instructive and enjoyable as any that have preceded it.

MARITIME ELECTRICAL ASSOCIATION CONVENTION.

The annual convention of the Maritime Electrical Association will be held in the city of Halifax, N.S., on Tuesday, April 18th, 1899. The outlook for the convention is quite promising, and the officers hope for a large attendance of members and persons interested in the electrical business. Following is a copy of the preliminary programme :

The convention headquarters will be at the new Victoria Hotel, corner of Morris and Hollis streets, and the meetings will be held in the Assembly room. The programme will be as follows :

9.30 a.m.—Meeting of the Executive Committee.

10 a. m.—President's address ; report of secretary-treasurer ; report of committees ; election of officers ; general business.

2 p.m.—Papers will be read by various members on : "Iron Armoured Conduit Wiring," "Fire Alarm Systems," "Steam Engineering," "Telephone Work" and "Electric Meters." Questions which have been suggested by the members will also be discussed.

In the evening a reception, consisting of banquet and smoking concert, will be tendered by the Halifax members of the Association. No effort is being spared to make this convention a success from every point of view ; and all members attending will not only receive some very practical information from the papers to be read and the discussions which will follow, but will also find the occasion a most enjoyable one socially.

It is hoped that each individual member will not only endeavor to be present, but will also try to induce any eligible persons in his vicinity to send in applications for membership.

Members will purchase a single first-class ticket from their station to Halifax, getting at the same time a standard certificate, which, after being signed by the secretary, will entitle him to a return ticket free if ten or more have come by that line ; if less than ten, a return ticket at half price.

Mr. W. H. Preece, C.B., F.R.S., has recently retired on a pension from the position of engineer-in-chief and electrician to the British General Post Office, he having reached the age limit of 65 years. He will, however, continue to act in a sort of consultative capacity to the post office, and in addition will carry on business on his own account in consulting electrical work in connection with lighting and traction. His connection with the telegraph and telephone extends over a period of 47 years. No announcement has yet been made as to who will be his successor.

QUESTIONS AND ANSWERS.

"S.T.D." writes: Will you kindly answer the following questions through the ELECTRICAL NEWS:

1st. What is the rule to find the amount of friction caused by the working parts of a machine, for example, say the piston, crank bearings, etc., of a steam engine of 100 h.p.

2nd. How do you find the striking force by gravitation—say a block of iron weighing 100 pounds dropped from a height of 100 feet.

3rd. Give rule to calculate the horse power developed by water, with a head 25 feet high and an outlet 3 feet square.

ANSWER.—1st. The easiest way of finding the amount of friction caused by the working parts of an engine is to take the brake horse power and subtract the same from the indicated horse power, and the difference is the amount spent on friction. In an engine the friction is distributed approximately as follows: Main bearings, 40%; piston and rod, 27%; crank pin, 7.%; crosshead and wrist pin, 5.5%; valve and rod, 14.%; eccentric strap, 5.5%. The ordinary laws of friction for plain surfaces as given by Coulomb are:

(a) The friction between two bodies is directly proportional to the normal pressure between them.

(b) The friction is independent of the areas of the surfaces in contact.

(c) Kinetic friction is less than static friction, and is independent of velocity.

General Morin's experiments on axles showed practically the same general results as Coulombs for plain surfaces.

The following example will show how the horse power lost in friction is arrived at:

A shaft 3" diameter has two bearings, one at each end, and between these bearings power is distributed from pulleys by belts. The tension in these belts has a horizontal pull of 1000 lbs and a vertical downward force of 550 lbs. at right angles to the shaft. The pulleys and shaft weigh 1750 lbs. The coefficient of friction (π) between shaft and bearings is .06. Find the horse power lost in friction if shaft makes 200 revolutions per minute?

We have here two forces acting on the shaft, (1) a horizontal force of 1,000 lbs., and (2) the vertical force of 250 lbs., together with the weight of pulleys and shaft, or altogether 2,000 lbs. These forces are at right angles, therefore the resultant pressure on the bearings is $R = \sqrt{1{,}000^2 + 2{,}000^2} = 2{,}244$ lbs.

This weight may or may not be equally distributed on the bearings, but for our present purpose we may consider same as being distributed on one.

The work lost in one revolution is = No. of feet travelled × coefficient of friction × resultant pressure = π d u R

when d = diameter of shaft in feet.

π = coefficient of friction = .06.

R = resultant pressure = 2244.

u = 3.1416.

The horse power lost in friction is $= \dfrac{\pi \text{ d n } \pi \text{ R}}{33{,}000}$

when n = No. of revolutions per minute.

$$3.1416 \times \frac{3}{12} \times \frac{200 \times .06 \times 2244}{33{,}000}$$

$$\frac{22 \times 3 \times 200 \times 6 \times 2244}{7 \times 12 \times 100 = 33{,}000} = .64 \text{ h.p.}$$

By referring to tables the coefficient of friction can be found or same can be arrived at by experiment.

2nd. The energy possessed by a moving body is obtained by finding the height through which it must fall to acquire the velocity of the motion. If this height is obtained the work done is equal to the height in feet × weight in pounds, or if

w = weight in lbs. and h = height in feet

the work done = w h foot pounds.

Therefore 100 lbs. × 100 feet = 10,000 ft. pounds would represent the amount of work stored up in the weight. This amount must be used up before the falling body can be brought to rest.

3rd. The power of a water fall is equal to the weight of water discharged in unit of time × total head.

If Q = cubic feet of water discharged per minute

W = weight of 1 cubic foot of water = 62.36 lbs.

H = total height in feet.

Then $\dfrac{\text{Q W H}}{33{,}000}$ = horse power.

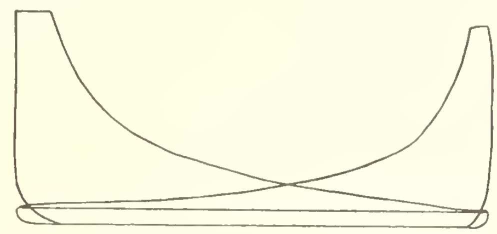
In the question the velocity of the stream is not given. This can be readily ascertained by measuring off say 100 feet on the bank, and throwing a piece of wood in the stream, and noting the time in passing the 100 feet marks. The average velocity is about 80% of the surface velocity.

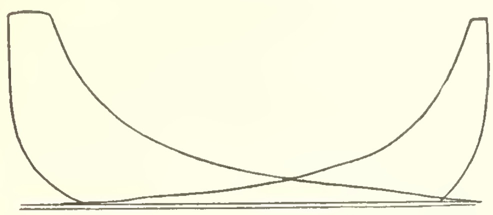
The number of cubic feet that could flow through an outlet 3 feet square is about 2,200 per minute.

$$\therefore \frac{2{,}200 \times 62.36 \times 25}{33{,}000} = 104 \text{ h.p.}$$

From this amount would have to be deducted friction on turbine, etc., and the net available would be about 70 h.p.

"J.M.," Aylmer West, Ont., sends us indicator cards taken from a Wheelock engine, with the request that we work out the results





for him. The original cards were 3½ inches in width, but as herewith shown are reduced by one-third.

ANSWER.—The diagrams, which we will call Nos. 1 and 2, were taken from a Wheelock engine, No. 1 with condenser on and No. 2 with condenser off; engine, 14 × 34; revolutions, 90; steam pressure, as per gauge, 100 lbs.

Area of piston, 153.93".

Speed of piston, 510'

Constant, $\dfrac{153.93 \times 510}{33{,}000} = 2.38$ h.p.

From card No. 1 the mean effective steam pressure is:

Crank end, 17.0.

Bright end, 21.6.

Average, $\dfrac{21.6 + 17.0}{2} = 19.3$ lbs.

Mean effective from the vacuum is 6.8 lbs.; total mean effective, 19.3 + 6.8 = 25.12, and 25.12 × 2.38 = 59.78 h.p.

Diagram No. 2 scales as follows:

Crank end, M.E.P., 14.2.

Bright end, M.E.P., 18.6.

Total, $\dfrac{18.6 + 14.2}{2} = 16.4$ lbs., and 16.4 × 2.38 = 39,032 h.p.

The back pressure on this card is 2 lbs. This would represent 2.38 × 2 = 4.76 h.p., which is not taken into consideration in scaling for the above M.E.P., and should be added as load on the engine.

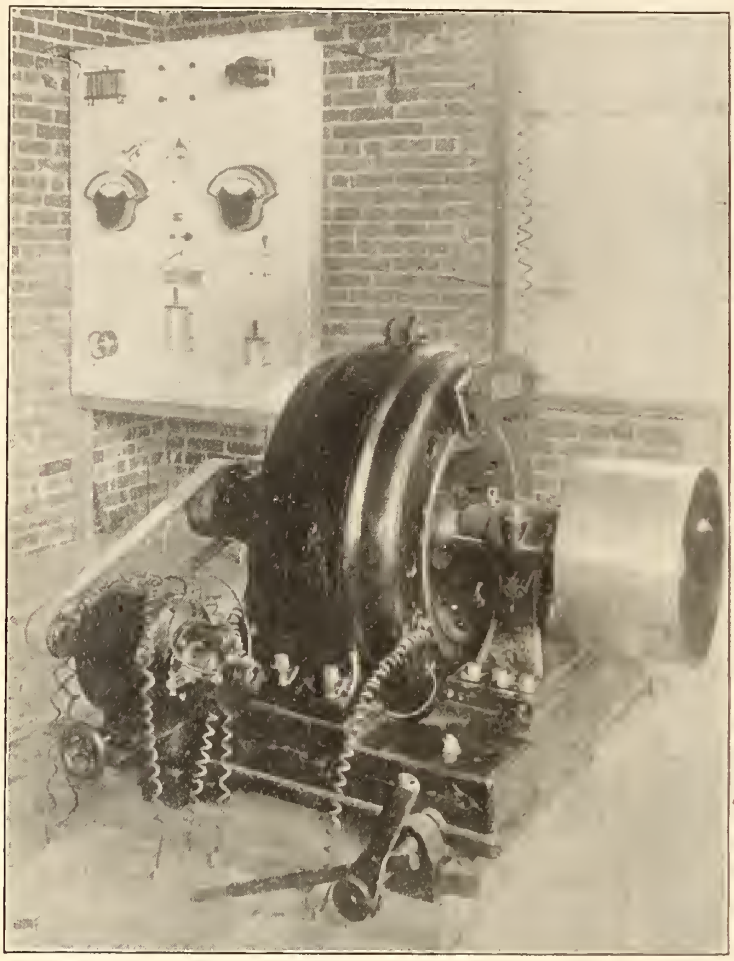
PREVENTION OF SCALE IN BOILERS.

In an article in the November issue of the Home Study Magazine, in answer to the question, 'Will carbonate of soda or plain soda remove hard sulphate of lime scale?' the expert replies, 'I have never found it to be much good for that purpose. I can tell you, however, what will remove it pretty effectually—very cheaply too—and that is ordinary kerosene. If this is fed to the boiler at the rate of about one quart per day per 100 h.p., the benefit to the boiler will soon be apparent. It has also been found to prevent, to quite an appreciable extent, the formation of hard scale. Its action upon the sulphate of lime does not seem to be a chemical one, however, but rather a mechanical action. In my opinion, the minute particles of sulphate of lime precipitated by the action of heat, are first carried to the surface of the water by the boiling and bubbling of the water. There they become coated over with the kerosene, which prevents them from uniting in solid mass when deposited on the plates.'

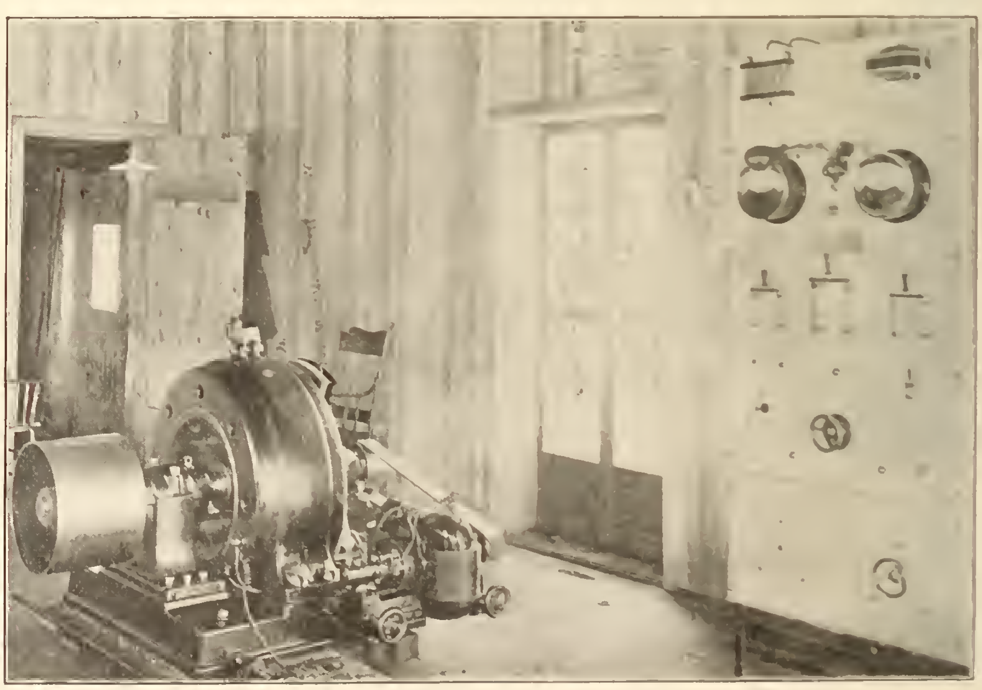
The Weston Electrical Instrument Company are making contracts for their new factory at Waverley, N.J., a suburb of Newark. A railway switch is now being constructed to the spot, and ground will be broken in a few days for the erection of what will probably be the most complete manufacturing establishment in the United States.

TWO MUNICIPAL LIGHTING PLANTS.

We print herewith illustrations of municipal lighting plants recently installed by the United Electric Company in the towns of Acton and Beeton. Some particulars of the former were printed in a previous number. The plant is installed in a stone building, 24 x 50 feet, and includes a 50 kilowatt alternating current generator with a capacity of 800 incandescent lights, a 2 panel marble switchboard fully equipped. Power is supplied by a 75 h.p. Wheelock engine manufactured by the Goldie & McCulloch Co., of Galt. The main driving belt is 16 inches in width and 65 feet long, and the dynamo a 10 inch, double, endless. There are fifty-six 32 candle power incandescent street lamps, arranged in two circuits independent of each other, and a third independent circuit for domestic and commercial service. The Beeton plant is very similar to the one at Acton. Besides furnishing light for the streets and commercial and domestic use current is supplied for 200 incandescent lights at the County House of Industry.



Municipal Plant, Beeton, Ont.



Municipal Plant, Acton, Ont.

In a letter to the Company the reeve of the municipality expresses his appreciation and that of the citizens with the satisfactory working of the plant, and refers particularly to the good regulation and freedom from heating. Over 600 16 c.p. lights have already been installed.

GLASGOW AND ELECTRICAL PROGRESS.

Although Glasgow may consider itself in many respects the centre of light and leading, it has by no means made astonishing progress in municipal electrical work. The population of Glasgow is 657,000, and the rateable value £4,046,726 ; Manchester, on the other hand, has a population of 530,000, and a rateable value £2,911,083. Curiously enough, the municipal control of electric lighting commenced in these cities within a few months of each other, but the latest returns show a marked difference in the two systems, as will be seen from the following figures :

	35 watt lamps.	Units sold.	Revenue.
Manchester......	123,595	1,748,244	£38,253
Glasgow..........	79,140	1,090,959	£25,862

For years past the Glasgow Corporation has owned probably the most paying system of tramways in the kingdom, and four or five years ago a committee collected an amazing mass of information on the subject of working tramways by electrical means ; moreover, it was generally accepted that electrical working was far and away the best system. Four years ago the tramways in Leeds were owned and worked by a company, yet to-day the Corporation of Leeds has not only taken over the whole of the city tramways, but has equipped 10 miles with the overhead trolley system—and Glasgow to-day is in a difficulty about running a short experimental line on the same system. Notwithstanding, Glasgow has sufficient confidence in itself to be desirous of of acquiring and working a telephone system.—Electrical Review, London, Eng.

CAPT. JAMES WRIGHT.

It is with much regret that we chronicle the death of Capt. James Wright, mechanical engineer, of Montreal. By his wide circle af acquaintances throughout Canada he was held in highest esteem, not only in recognition of his great ability in his profession, but also of his many sterling personal qualities. To such the accompanying portrait and biographical particulars will be of interest :

Capt. James Wright was born in Tarbolton, Ayrshire, Scotland, Sept. 23, 1826, and when about 12 years old emigrated to New York, where he received a common school education and at about 16 years came to Allenburg, Ont., where he served his time and learned the trade of blacksmith with an uncle. He then went to work with Jas. Oswald, a contractor, and got his first experience with dredging machinery in the harbors of Boston and New York, and later on in the Erie and Welland canals. He then came to Montreal with the first spoon dredge used in the Montreal harbor, and finally became mechanical superintendent of the Montreal harbor, which position he occupied for twelve years. In 1876, together with F. B. McNamee and A. G.

Capt. James Wright.

Nish he formed the firm of F. B. McNamee & Co., which firm constructed that portion of the Montreal water works acqueduct, known as the Inland Cut, the Carillion dam across the Ottawa river, and took part in the deepening of Lachine and Welland canals, and the Toronto water works extension. Leaving the firm he then took up the business of a mechanical expert, and as an authority on the steam indicator was well known.

In 1885 together with A. G. Nish and M. F. Lefebre, he formed the Mount Royal Park Incline Co., which firm built the present incline railway up the side of Mount Royal, from plans drawn up by him and directly under his supervision.

Capt. Wright was noted for his wonderful memory, and it is said was never known to forget anything he had read twice.

He leaves a wife and one son, an electrical engineer in Mexico.

Judgment has been reserved in the action brought to ascertain whether the mortgage held by the Sun Life Insurance Co., against the Cornwall Electric Street Railway Co., covers the rolling stock, extensions, etc.

EDUCATING OPERATORS IN THE HANDLING OF THE SWITCHBOARD.*

Writing a paper to be read before the members of the association is a difficult task for me, knowing full well that anything I might write, on any subject, would in no way compare with any paper prepared by any other member of the association. But if in writing a paper I chance to say anything that will be of any benefit to the association in general, or a single memrer of the same, I will feel that I have been amply paid for the effort.

In the beginning I will say that the chief trouble to the telegraph service on railroads is the inefficiency of operators. An operator may be able to handle train orders and other business in a highly satisfactory manner ; he may be a good sender and attentive, and still not be able to make the simplest kind of a patch in case of wire trouble when called upon to do it by the dispatcher. This one failure on his part very materially reduces his value as an operator, and the dispatcher, in nine cases out of ten, reports him as being unfit for his position, which is true to a certain extent.

Mr. A. R. Lingfelt produced a paper that was read before the members of the Association at the meeting of 1-94, which was able, concise, and deserved far more than a passing thought. Too much can not be said or written on this subject. Any one giving the matter careful thought can not help but see that the question of educating operators in the workings of the switchboard is one that demands serious consideration.

In hiring and placing operators, I feel sure that superintendents of telegraph and chief dispatchers do not always handle the matter as it should be handled. In far too many instances they hire and place an operator wholly on the grounds that "he is a fair operator, can handle train orders well, make a fair copy, and has a good record as to character." These qualifications are certainly essential, but his qualifictions ought not to end there. We will say that he is hired and sent to "J" to work nights. The dispatcher has outstanding orders to trains all over the division ; a storm comes, playing havoc with the wires, putting the train wire in a useless condition ; the dispatcher locates the trouble, and soon sees that he can get a through train wire by having the operator at "J" put No. 7 north to No. 10 south. He instructs him to make the patch, and finds out, to his disgust, that the operator cannot do it, and trains might remain tied up until doomsday, just because an operator does not know how to make a simple patch. As a general thing, when a dispatcher wants a wire, he wants it like the "man in Texas wanted the revolver ;" that is, bad ; and if he don't get it promptly—and his disposition is not the best in the world—he is apt to abuse the operator for being unable to render the proper assistance. This is wrong. The operator is not to blame. The official placing him in the office is far more responsible than the operator is, because the chances are that no one ever showed the operator how to manipulate a switchboard. Under the circumstances, he could not be expected to do it. Had he been shown by the superintendent of telegraph or chief dispatcher how to do such work before he took charge of the office, and been told plainly that he must be able to do such work when called upon, or would not be retained in the service, the chances are that he would have made a study of the

* Read before the Association of Railway Telegraph Superintendents, Fortress Munroe, Va., by W. F. Packard, of Lima, Ohio.

board from the time he went into the office, and would have been able to have made the patch when it was required of him.

One of the greatest troubles is wire failure, and if patching can not be done promply, trains have to suffer. If operaters do not know how to do it, it can not be done.

I do not wish to write or speak disparagingly of operators, or officials placing them, but I will venture to say that any division on any road in the country can be selected that has 20 offices, and there will not be more than two operators on it that can make a simple patch of one wire north to another south, east or west, unless they have had previous practical instructions. I do not think I have overdrawn this. I base my statement on the observations I have made during the years of experience I have had as a train dispatcher and in other capacities. I have never worked on a road that my experience has not been about the same in that respect. In my opinion, it lies with the superintendents of telegraph and chief dispatchers to obviate a great deal of this trouble.

No operator should be placed in charge of an office unless he is posted in working a board of an ordinary kind by the official placing him. He should be shown how to do patching, the position of the plugs when wires are in their normal condition or position ; in fact, the back straps should be gone over, explaining their relation to the plug strips, etc., etc. This would take but little time, and would be starting the operator in right.

There is another thing that could be done that would certainly prove to be a great benefit ; that is, to provide every office with a blue print or hektograph drawing of the standard switchboard, showing it in its natural condition. Plug holes should be numbered on the print. This, together with a "key" at the bottom or top of the print, showing where to place plugs for certain patches, would render the work simple, so much so that any one who could read could do it.

Any operator of limited experience, after working in an office a short while equipped as I have shown ; would be able to handle the board in any office whereever he might be placed, as there is no radical difference in boards now in use on nearly all the roads in the country. I feel sure that such a course as I suggest, if adopted on railroads, would not only benefit the telegraph service to a great extent, but raise the operators to a higher plane of usefulness.

Any superintendent of telegraph or chief dispatcher should be able to make a crude drawing of the print I refer to, to enable the engineering department to make the print. They could be made in the above department at a small cost, and in such a shape that they would meet all that would be required of them for the equipment of offices.

This communication is not intended as a criticism on any one hiring or placing operators, or on the operaors themselves, but is written with a view of offering suggestions that I hope may turn some thought in the direction referred to, and that some practical improvement may be made.

The Dominion Oilcloth Co., of Montreal have placed an order with the Royal Electric Co. for the complete equipment of their factory with S. K. C. motors, aggregate over 150 h. p., the different units as required throughout the building in the different departments.

ELECTRICAL INSPECTION IN WINNIPEG, MAN.

A REPRESENTATIVE of the ELECTRICAL NEWS lately interviewed Mr. F. A. Cambridge, the newly appointed city electrician of Winnipeg, Man, in reference to electrical inspection. He learned that all new wiring and electrical installations have to be done in strict conformity with the National Code, 1897 edition, which is incorporated in the city regulations. No electrical work can be undertaken without a permit, and certificate must be obtained before work is finally passed. No fees are charged either for inspection or permits. Some difficulty has been experienced owing to the fact that the improved list of the National Code does not include many articles of Canadian manufacture. Mr. Cambridge hopes that before long other cities in this country will follow the example of Winnipeg, and that there may be formed some kind of a testing bureau, preferably by the associated Underwriters' associations, presided over by some reliable expert, who may be referred to in matters of dispute, or from whom impartial opinions may be obtained regarding materials or practice. In this connection Mr. Cambridge acknowledges the great kindness of Mr. Merrill, jr., the chief electrician of the National Board of Underwriters for America. That body maintains a complete bureau at Chicago. Winnipeg is acting in connection with the bureau, and gives and receives full accounts of all electrical burnouts, etc.

Regarding old installations it is understood to be the intention of the city electrician of Winnipeg to make a thorough inspection of all these. Some progress has been made already and the general public as a rule are pleased to carry out the alterations ordered. Mr. Cambridge believes that this work should be taken up at once by every city, for the longer it is left undone the greater expense the public will ultimately have to bear.

ELECTRICAL EXHIBITION.

THE twenty-second convention of the National Electric Light Association and third Electrical Exhibition is announced to be held in Madison Square Garden, New York, during the month of May. The scope of the exhibition will not be confined merely to electrical apparatus and appliances, but will include all kindred industries as well, such as various makes of boilers, pumps, steam engines and other steam specialities. A special feature of the coming exhibition will be the display of patents and new devices. Last year the Electrical and Kindred Industries Exhibition was held under the auspices of the New York Electrical Society, but this year it is proposed to hold it in conjunction with the convention of the National Electrical Light Association. As a result, considerable interest has been awakened in the coming exhibition.

The subject of the construction of an electric railroad from Guelph to Hespeler, Arthur and Erin, is engaging the attention of the Board of Trade and citizens of Guelph. It is stated that if $25,000 to $30,000 of local capital can be raised, capitalists can be found who will contribute the additional amount required.

The British Columbia Electric Railway Co. will no doubt pay a good dividend in the near future. The net earnings of the company from April 1st last to the end of the year amounted to $126,487, as against $67,582, for the like period of 1897. The company are now erecting a large car barn at Vancouver. Mr. J. M. Buntzen, manager of the company, has gone to England, where he will lay before the directors plans for several extensions of the system.

TRIAL BY JURY.

TRUTH is stranger than fiction. Gilbert and Sullivan, in the wildest flights of their imagination could not have portrayed a more farcical denouement than that of a verdict brought in by a jury of twelve of our fellow countrymen at the assizes at Toronto. The case was that of Harris v. Toronto Electric Light Co. for $10,000 damages. Harris was a purveyor of rags and bottles, and kept these rags and bottles in a rough-cast building. In this building he had in use a motor, supplied with current from the wires of the defendant company. These wires were tapped on Harris' premises by a small pair of wires, which were attached to a corner of the rough-cast building aforesaid, and from thence taken over to a doctor's residence on the next street. Herein lay the offence—the wires leading to another man's premises were run on sideblocks on the outside of the rough-cast rag emporium, as the plaintiff said, without his consent. He saw the wires being so attached and enquired of the linemen what they were for, and was told. He made no objection. The wires remained there two years or more, and never a word was said. On the 18th of September last—a Sunday afternoon—the rags, as rags often will, ignited spontaneously or got on fire in some way, and the rag shop was laid in ruins. As the flimsy walls collapsed, the wires attached to the outside were tangled up and, of course, short-circuited, and burnt the insulation. Harris promptly brought suit for ten thousand dollars against the company defendant. The case was tried in Toronto last week.

The nature of the evidence put in may be gathered from the testimony of one of the witnesses. This was a lady who was oppressed with a foreboding that Harris's was to be destroyed by electricity. She said that she had frequently seen the electricity running up the wires on William street from Queen street and turning the corner and going into Harris's, and on this identical Sunday she had seen some of it go up the street and cross over into the rag bureau about two hours before the fire. Several other witnesses also testified that they saw the wires flashing fire, and then the raggery burst into a blaze of glory. There was a remarkable unanimity in their testimony—first, fire on the wirés, then immediately the flames bursting out from the inside and through the roof. This was about the time of the arrival of the fire apparatus. These witnesses all were on the south side of the building.

Now for the defence. The evidence of several reputable witnesses living on Simcoe street, to the east of the building, went to show that they were the first to see the fire; that it started in the centre of the building entirely away from where the wires were attached; that they telephoned the alarm to the police station at 2.35, and that at this time there was no fire outside the building at all. Evidence was produced by a number of witnesses that the short circuit caused by collapse of building occurred at the power house at 2.47, or 12 minutes after the alarm was given, and probably 20 or 25 minutes after the fire broke out. The evidence of these witnesses was clear as to the facts.

As to the values. It appears that Harris had appealed on his assessment and took an oath before the Court of Revision three days before the fire that there was not five hundred dollars' worth of goods in the place, and that a big pile of the stuff represented very little money. Two members of the Court of Revision were put upon the stand and testified to this. He now swore there was eight thousand dollars' worth. The defendants could not contradict, as the evidence was destroyed—Harris kept no books.

His Lordship was impressed throughout the case with the evidence submitted by the plaintiff's witnesses, on the ground that their statements were based on what they had seen with their own eyes. On the other hand, little or no importance was attached apparently by the jury to the evidence of the other gentlemen who said that they saw the fire start in another place and gave the alarm. The onus was upon the defendants to prove that the contents of the building were not worth $10,000; this they had failed to do. As to the plaintiff's sworn statement before the Court of Revision regarding the value of his goods, it was not allowed to affect his veracity in the present case. His Lordship left to the jury the difficulty of accounting for the difference in time between the fire alarm and the starting of the fire and the time of the short circuit at the company's works.

The jury went out and deliberated for a couple of hours, and then came into Court and asked the Judge if they could not make the damage $14,000 instead of $10,000! The Judge appeared staggered at this, and he instructed them that they could not award more than was claimed, so they made it the ten thousand.

The only serious feature of this case appears to be the position in which the defendant company is placed by the jury's award, and the effect of the decision upon electrical companies throughout the country. There is no doubt that every company doing business has a number of these double services in operation. Electric light companies will be kept in hot water unless they find means to protect themselves. This can be done by special agreement before entering upon any person's premises for purposes of business—an iron-clad agreement of protection and indemification from risks of damage of every kind—alleged and actual—from fire, flood and the fortunes of war.

MOONLIGHT SCHEDULE FOR APRIL.

Day of Month	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 6.50	A.M. 1.00	6.10
2....	" 6.50	" 1.30	6.40
3....	" 6.50	" 2.20	7.30
4....	" 6.50	" 3.00	8.10
5....	" 6.50	" 3.40	8.50
6....	" 6.50	" 4.20	9.30
7....	" 7.00	" 4.40	9.40
8....	" 7.00	" 4.40	9.40
9....	" 7.00	" 4.40	9.40
10....	" 7.00	" 4.40	9.40
11....	" 7.00	" 4.30	9.30
12....	" 8.00	" 4.30	8.30
13....	" 9.40	" 4.30	6.50
14....	" 10.20	" 4.20	6.00
15....	" 11.00	" 4.20	5.20
16....	" 11.10	" 4.20	5.10
17....	" 11.50	" 4.20	4.30
18....	....	" 4.20	3.50
19....	A.M. 12.30	.....	
20....	" 1.20	" 4.20	3.00
21....	" 1.50	" 4.20	2.30
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	P.M. 7.00	P.M. 9.20	2.20
27....	" 7.20	" 10.20	3.00
28....	" 7.20	" 11.20	4.00
29....	" 7.20	A.M. 12.20	5.00
30....	" 7.20	" 1.00	5.40
		Total.........	160.40

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Water Power Problems.

The severity of the weather during the past winter proved a serious obstacle to the operation of water powers, more particularly at Lachine and Niagara, where Jack Frost seemed determined to seal up the water supply and compel the closing down of the electric power stations. The water in the canals leading to the stations on both sides of the Niagara river was diverted by masses of ice which became attached to projecting rocks above the falls. On several occasions the Niagara Falls Park and River Railway was obliged to cease operations on account of lack of water due to the above cause and to the blocking of the water inlet. Reference has been made in previous issues to the unusual difficulties under which the plant of Lachine Rapids Hydraulic and Land Company was operated owing to the large accumulation of frazil or anchor ice. These troubles emphasize the fact, says the Electrical Engineer, that hydraulic engineering can no longer be excluded from the scope of a complete electrical engineering education, any more than civil and mechanical engineering.

The Consolidation Idea.

The rapidity with which enormous business combinations are being formed in the United States is the most wonderful feature in the record of recent events. The trend of business and capital in this direction is being watched with the greatest interest and not without anxiety as to the outcome. Naturally the influence of these combinations is felt in Canada, and there is a disposition to follow on a smaller scale the example so daringly set us by our neighbors. Combinations have already been effected between several of the most important financial corporations of Toronto, with a prospect of more to follow. It is reported that the Canadian manufacturers

of bicycles will be forced to form a trust among themselves or become a part of the combine recently formed in the United States. The electrical interests are also likely to be affected. Indeed, a report is current that negotiations are now in progress for the consolidation under one management—probably that of the Cataract Construction Co.—of the various electric lighting and street railway companies whose headquarters are in Hamilton. We certainly think that benefit would accrue to the industry from the amalgamation of a number of the rival lighting companies wnich are now engaged in the unprofitable and thankless task of cutting one another's throats in some of the smaller towns.

The Conmee Bill

In this issue will be found Mr. Conmee's Bill as adopted by the Ontario Legislature, defining a method for the adjustment of disputes between municipal corporations and private electric lighting companies as well as the terms upon which municipalities shall in future be permitted to engage in the business of public lighting. The measure has been carefully framed, and when put in operation will no doubt prove advantageous to both the municipalities and the companies. It puts an end to a condition of affairs under which electric lighting companies were in constant danger of having their property wiped out of existence by the municipality, and therefore were not in a position to make further investments for necessary improvements. On the other hand the municipality is now able to secure public lighting from the companies on their own terms or at a price which competent arbitrators shall decide to be reasonable and fair. During the time that the Bill was before the Legislature it was subjected to much unfair criticism and opposition from some of the public newspapers, which, in their anxiety to appear as public champions, did not take the trouble to learn what its provisions were. Since its adoption they have declared that the electric lighting companies will now proceed to tyrannize over the municipalities. A perusal of the Bill will show that even should the companies desire to act the part of tyrants, which they certainly do not, the restrictions put upon them by the new legislation are a sufficient safeguard to the public interests. In consequence of the relations between lighting companies and municipalities having been thus defined, there is likely to be a return of confidence leading to the investment of capital in the improvement and extension of electric lighting properties.

Price of Elecric Power.

THE councillors of the town of Orillia, Ont., apparently have but a vague conception of the cost of producing electricity. As our readers know, they are about to embark upon an undertaking to supply light and power to the town from Ragged Rapids, nineteen miles distant, this being the first instance in Canada, if not in the world, of a municipality installing a long distance electrical power transmission plant. There are two essential features necessary to the successful operation of any plant, whether controlled by public or private interests. The first is, that the design and construction of the plant shall be as nearly perfect as possible, and adapted to the conditions under which it must operate; the second is of equal importance, that the power shall be disposed of at a price which bears due relation to the cost of production. As to the design and construction of the Orillia plant it is yet too early to speak definitely, but in this respect we anticipate no obstacle to success. Our skepticism is aroused, however, by the price which has been placed upon the power to be produced, and we are led to the conclusion that upon this point the councillors must have shouldered the responsibility themselves, instead of obtaining proper advice. It is reported that power is being offered, delivered in Orillia at about fourteen dollars per horse power per annum, while the town of Gravenhurst which recently applied for power, was quoted a price of ten dollars per horse power per annum for one or two hundred horse power, at the power house at Ragged Rapids, the town to build and maintain its transmission line and transformer station. We believe that these prices will be found to be below the actual cost of operation, and that if the plant is to be a financial success, the rates for current must necessarily be increased in a substantial degree.

Copper and Aluminium.

There is no occasion to doubt the tenacity of the grip which the copper trust of the United States have secured. Prices have been forced upward to an extent which has very seriously affected the electrical industry in particular, as well as many other departments of trade. We are advised that many electrical enterprises which had been planned for this season, are hanging fire because of the unexpected and serious increase in cost of construction due to the heavy advance in copper. Building enterprise in cities where electric wiring is employed is being hampered from the same cause. Under these circumstances the electrical fraternity will watch with interest the experiment which is to be made at Orillia with aluminium as a conductor. Reference was made in our last issue to the fact that with the consent of the municipality of the town of Orillia a contract had been given to a Pittsburg firm for aluminium wire conductors for the electric transmission system at that place. The manufacturers of aluminium wire are to be congratulated upon the opportunity thus afforded them to demonstrate its utility and advantages for electrical purposes. It may occasion surprise that the Council of Orillia should have consented to allow the new material to be used for so important a transmission line. It is understood however that the town's consulting engineer, Mr. R. J. Parke, has carefully investigated the matter and is satisfied that aluminium wire will meet the requirements, and at a substantial reduction in cost. Furthermore the contractors have given the municipality their written guarantee concerning the tensile strength, conductivity, durability and less liability than copper to physical disintegration under the natural conditions which may affect the transmission line while in operation on the poles, and have undertaken to replace and put in satisfactory working condition any wires which may prove defective. The conductivity of pure aluminum wire is given as 63% and about 54% when containing 2% of alloy. The tensile strength of pure aluminium in sizes such as will be required for the Orillia line is about 24,000 lbs. It is proposed however, to employ a wire with a conductivity of 59% and a tensile strength of 29,000 lbs. per square inch. Assuming that aluminium has a conductivity of 59% and copper a conductivity of 97% the comparative cross-section of aluminium wire of equal conductivity to copper will be as 163 to 100. The diameter of No. 4 B. & S. copper wire, which would be the size required

for this line, is .204, or an area of 41742 circular mills. It is estimated that aluminium wire of equal conductivity should have an area of 68,000 circular mills and a diameter of .260. The weight of aluminium as compared with copper is 3.33. The weight of aluminium of equal conductivity with copper, is 49 per cent. of the weight of copper. As to comparative price, assuming a fair price for copper to be 20 cents per lb., 41 cents per lb. for aluminium would give the same cost per mile of line work, inasmuch as the weight of the aluminium would be only 49 per cent. of the weight of the copper. It is understood that the manufacturers of aluminium are watching very closely the copper market and are advancing or lowering the price of their material in such a way as to be able to offer an inducement to purchasers, while not letting go more profit than is absolutely necessary. Owing to its greater cross-section, due to lesser conductivity, the cost of insulating aluminium wire is almost double that of copper wire. Thus there is little or no advantage in price, except where bare wires can be used. This fact will greatly restrict the use of the new material. The only transmission line thus far constructed with aluminum wire is that of the Snoqualmie Falls Power Co., Seattle, W. T. This line, including branches, is 74 miles in length, and was completed in the autumn of last year, but has not yet been put in operation, so that no practical working results are obtainable.

BY THE WAY.

MR. Carter, an old time Canadian operator tells an interesting story of his work with Edison 25 years ago. The two were working at Stratford, where Edison was station telegraph operator. There was a mistake in some order, and a collision was narrowly averted, Edison in consequence, had to face the superintendent at the old Union Station, Toronto, who rated him roundly for his "criminal carelessness." It was more than the young genius could stand, and, quietly exclaiming that he had had enough, Edison slipped on his coat and then severed his connection with the company. A short time ago Mr. Carter visited Edison at Jersey City, and the two laughed over the Stratford episode.

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THIS is the way municipal control of the electric light and telephone has worked out at Crawfordsville, Ind., as recorded in the Indianapolis News of March 15th: "More rottenness is being unearthed by the investigating committee of the city council. Last week it developed that a number of city employees were supplied with telephones for which the city paid, and last night it came out that a number of others are supplied with free service by the management of the city electric light plant. All those connected with the plant are said to be using the light without price, whereas the management began to refuse pay applicants on the service some time ago, on the ground that the plant was already loaded to its carrying capacity. It now develops that every employee of the plant has his house wired and is using all lights desired. The exposure has caused a breeze of indignation, and the superintendent has been ordered to cut off all deadhead service at once."

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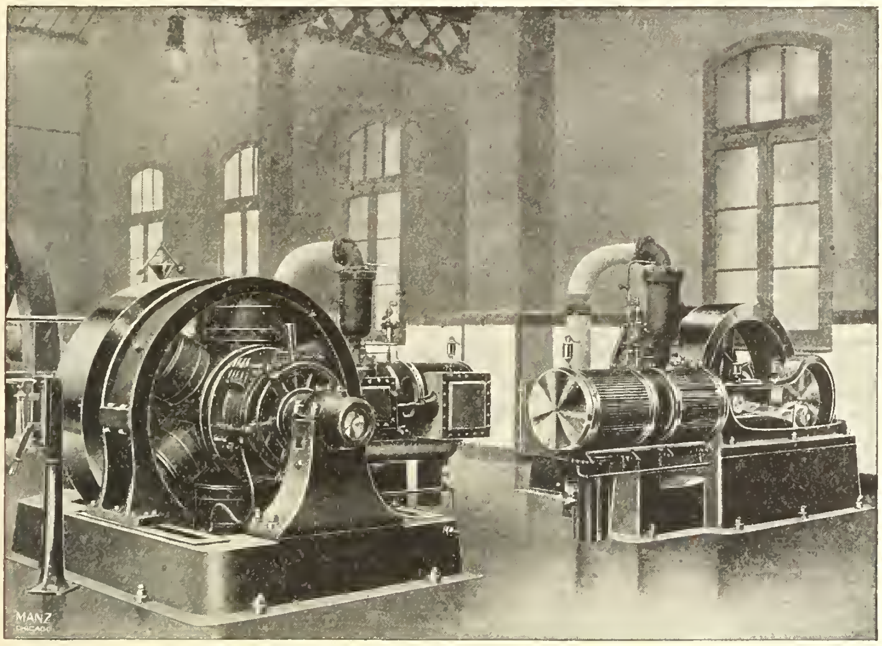
IN the early '80's, when electricity was indeed in its infancy, Mr. J. J. Wright, the present manager of the Toronto Electric Light Co., started into the business on a very modest scale in Toronto. He rented a small machine shop off Yonge street, and there made his own apparatus. No attempt was made to light the streets, but a number of the stores were served with arc lights. In the day time the promoter of the new enterprise was busily engaged in stringing wires, trimming lamps and soliciting customers, and at night he took charge of the operation of the plant and the construction of dynamos and other apparatus. He even tried his hand at making carbons in the hope of reducing their cost, the price then being nine or ten cents apiece. In the following extract from a letter written to a friend Mr. Wright describes in characteristic language the modus operandi of carbon making as practiced by himself: "The first carbons I ever made or used were round in the shape of a wheel and I rammed the stuff in a cast iron mould and then made the mould red hot something after the manner of the Chinaman who when he wanted roast pork burnt down his house to cook the pig. You make me smile when you ask me the resistance of the first carbon I used. In those days I was 'unacquainted with the nature of an ohm' so to speak, and considered myself pretty lucky if I could get a current to go through my carbons on any terms. I wasn't fastidious. I didn't require to know system, candle power and strength of current in use' and whether coppered or plain—not much—I was perfectly satisfied when I could make a carbon that wasn't an insulator, and did not worry myself into a decline because two of them did not last an equal time on the same current to a fraction of a second. The first carbons I remember as practical carbons were Brush. They were square, but I have no data respecting them. Since then, I have used every kind, round, square, soft, hard, some with a hole through the center and some with a core, but I never knew what fun was till I started in to make carbons in Canada. I didn't have the first idea what they were made of and had to work it all out for myself. Carbons were costing me from 9 to 10 cents each in those days and it was an inducement. If I was to tell you the different kinds of stuff I put in carbons, you would die standing up. You would not have time to fall down. I got very fair results from gas carbon and molasses, but dropped the molasses and took to tar. The carbons were all right but would blaze somewhat. At last I got to making fair to middling carbons, but they were of the now-you-see-'em-and-now-you-don't kind. One lot would go all right, and then the next night my lamps would not start up, and after forcing the current round for a time, I would go round and find all the fine wire shunts burnt to a cinder. Another time they would get red hot all the way up to the holders and they would burn to a beautiful point. After a while I got to making them all right, and had pretty fair success, but the reduction in price knocked me out. I could buy cheaper than make, but if it were profitable to rake up such matters, I could a tale unfold in regard to what I know about carbons 'that would make your knotted and combined locks to part and each particular hair to stand on end like quills upon the fretful porcupine,' but of what avail? it would be of no use, so I have only to repeat what I said at the start, that for accurate data I am not there, but for experience, largely comic but quite often the reverse, I believe I could fill a book."

Charles J. Pippin, night watchman, at the parliament buildings Toronto, has been appointed engineer at the Deaf and Dumb Institute, Bellville.

CANADIAN ENGINES IN SPAIN.

In October, 1897, contracts were placed for the equipment of electric tramways in Barcelona and Madrid, the two most important cities in Spain. The work was completed a few months ago, and the lines are now in successful operation. Barcelona, with a population of about 600,000, is the largest city in Spain, and is an important seaport and manufacturing centre. It is an ideal city in many respects, but particularly from the standpoint of the owners of the electric railway, as it is well patronized on account of the climate being too warm for much walking. Madrid is the capital of Spain, and is nearly as large as Barcelona. It is situated inland, and has many parks, broad streets and fine buildings. In the character of its population it resembles a western American city, as not more than 40 per cent. of its residents are natives.



Robb-Armstrong Engines at Barcelona.

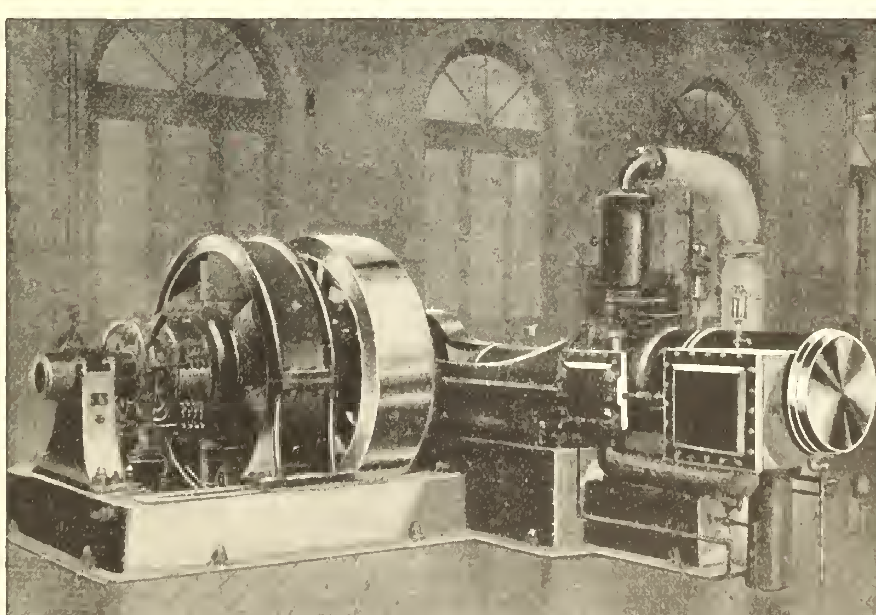
Although these systems are owned by British capital, and were built by British contractors, much of the apparatus was purchased on this side of the Atlantic. The main engines were manufactured in the United States, and three smaller engines were supplied by the Robb Engineering Company, of Amherst, N.S. These latter engines, as shown in the accompanying illustrations, are tandem compound, side crank type, with dynamos direct connected. They were installed principally for lighting the extensive car sheds and driving the machinery in the workshops connected with the tramway system, but are also used for running part of the cars late at night or early in the morning when the main engines are shut down.

The high pressure cylinder of these engines is 10 inches in diameter, low pressure 16 inches in diameter, stroke 15 inches, and they are rated at 115 horse power each. Both valves are controlled by the automatic governor in such a way as to divide the work equally between the two cylinders. The crank shaft, connecting rod and crank pin are of hammered open-hearth steel. The high pressure cylinder is placed next the frame, and the low pressure in the rear, so that the cylinder heads and pistons can be removed without disturbing the cylinders. The throttle consists of a flat valve rotated through one-half revolution by a lever, and as the valve and seat are protected from the steam whether open or shut, they can neither wear nor rust. The main bearings have a ring oiling device, the oil being continuously conveyed from a cavity beneath the bearing to the top of the shaft by metal rings which dip in the oil. All bearings are large and the parts of the engines few and simple and as strong as possible, making them well adapted to any service where continuous running and variable or severe work is required.

It is highly creditable to the Robb Engineering Company that their engines were selected as part of these installations, which are said to be the most important undertakings of the kind completed in any part of the world during the year 1898. The products of the Robb Company have been favorably known throughout Canada for a number of years, and we have no doubt their foreign shipments, which have been quite numerous during the past year will give as good satisfaction and lead to a large increase of their business.

ACETYLENE GAS EXPLOSION.

On January 5th the village of Merrickville, Ont., was startled by a terrific explosion, which, on investigation, proved to have occurred on the premises occupied by the A. B. Scott Co., general merchants, due to the explosion of their acetylene gas machine. The plate glass windows in the front of the building were almost totally wrecked; the windows on the second floor were also broken out. A large window in the centre of the back of the building was completely destroyed, being blown out, with its frame, leaving nothing but the brickwork. The cellar doors leading to the machine were broken from their hinges. Fortunately, no one was seriously injured.



Robb-Armstrong Engines at Madrid.

THE CONMEE BILL.

Following are the provisions of the Conmee Bill as adopted by the Ontario Legislature a week ago, defining the relations which shall in future exist between municipalities and electric lighting companies :

14. (1) Sub-section 4 of section 566 of the said Act is amended by striking out the first six lines and article (a) thereof, and inserting in lieu thereof the following words and articles (a) to (a9) inclusive :—

By the councils of cities, towns and villages.

4. For constructing gas, electric light or waterworks, and for levying an annual special rate to defray the yearly interest of the expenditure therefor and to form an equal yearly sinking fund for the payment of the principal within a time not exceeding thirty years and not less than five years for gas or waterworks, in the case of any such city, town or village, or for electric light works, in towns having a population of 5,000 or less, as ascertained by the latest census of Canada, and in villages and not exceeding twenty years or less than five years for electric light works in cities and towns having a population of over 5,000 as ascertained by such latest census. (a) In case there is any gas, electric light or water company incorporated for or in the municipality, the council shall not levy any such special rate, or construct works for lighting the public streets, until such council has, by by-law, fixed a price to offer for the works and property of the company or companies, nor until after thirty days have elapsed after notice of such price has been communicated to the company or companies without the company or companies having accepted the same, or without the company or companies, having, under the provisions of this Act, as to arbitrations, named and given notice of an arbitrator to determine the price, nor until the price accepted or awarded has been paid, or has been secured to the satisfaction of the company or companies, and in case the company or companies and the municipality do not agree, the said price shall be determined by arbitration under this Act : And where there is more than one such company in the municipality, the arbitrators shall determine the share or proportion of the price to be paid to each company. This clause (a) shall only apply to a gas or electric light company that has supplied or shall supply gas or electric light for street lighting in the municipality, or to a water company that has supplied or shall supply water for street hydrants in the municipality.

(a2) In any arbitration under clause (a) hereof to determine the price to be paid for the works and property of a gas or water company, the arbitrators shall determine the actual value of such works and property having regard to what the same would cost if the works should be then constructed or the property then bought making due allowance for deterioration and wear and tear, and making all other proper allowances, but not allowing anything for prospective profits or franchise and shall increase the amount so ascertained by ten per cent. thereof, and such increased amount shall be the amount which the arbitrator or arbitrators shall award as the price to be allowed for the said works and property.

(a3) In any arbitration under clause (a) hereof to determine the price to be paid for the works and property of an electric light company the arbitrators shall determine the actual value of such works and property having regard : (1) To what the same would cost if the works should be then constructed or the property then bought ; (2) to the condition of the works and to any deterioration thereof from use and wear and tear or by reason of the system or appliances having become in whole or in part absolete ; (3) to the value of such works and property to the municipal corporation for the purposes, and to the extent to which the municipality can make use of the same and to such value for commercial and such other purposes as a company could use them for ; and (4) to the cost of procuring more valuable or modern improvements or appliances therefor, if any, and the cost of acquiring the right to use and of adapting such improvements, the arbitrators making all proper allowances but not allowing anything for prospective profits or franchise, and such amount so ascertained shall be the amount which the arbitrators shall award as the price to be allowed for the works and property hereunder.

(a4) Where in any of the said municipalities the municipal council desires to construct works as aforesaid to supply light for street lighting and other public uses on highways, or to supply water for street hydrants and other public uses on highways, but not for commercial purposes, the council may, by the said by-law, limit the price to be offered as aforesaid to a price for part only or for the use of part or for the purchase of certain parts and the use of other parts of the works of a company, that is to say, to so much thereof as may be required for such public uses, and in the event of an arbitration hereunder thereafter held to determine as to such offer and price, the arbitrator or arbitrators shall have power after taking into consideration the effect of severance, if any, or user on the remaining property and business of the company to award a severance of the works if the arbitrator or arbitrators shall determine that after severance, if any, or user, the company will be, in all probability, having regard to the nature of the business and all the circumstances, in a position to successfully carry on that part of their business which consists in supplying private consumers at rates not less favorable to the consumers, the company to have the right to continue to operate the balance of their works for that purpose, and if the arbitrator or arbitrators shall so award a severance, they shall by their award, determine what part of the works the municipality shall acquire for said purposes before levying the said special rate, as well as the price thereof, but nothing herein contained shall affect the right of the council at any subsequent time to offer a price for the said balance of the said works, under the provisions of this Act.

(a5) And, if within one month, after the publication of any award made under article (a) or (a4) hereof the municipality shall give notice in writing to the company that they will not accept the terms thereof, their offer may be withdrawn provided they first pay all costs of the reference and award and provided also that in the event of such withdrawal the municipality shall not, until after the expiration of two years from such withdrawal be entitled to again avail themselves of the provisions of the clause under which the award is made.

(a6) In case there is any gas or electric light company supplying gas, electric energy or light or water company supplying water in any municipality the council may, by by-law, fix a price and terms to offer for the supply by contract by such gas or electric light company of gas or electric energy or light for street lighting and other public uses, or for the supply by contract by such water company of water for street hydrants and other public uses for a term of not less than five years and not more than ten years and after thirty days have elapsed after notice of such price and terms has been communicated to the company without the company's having accepted the same the council may, under the provisions of this Act, as to arbitrations, name and give notice of an arbitrator to determine the prices and terms of the contract for such supply of gas or electric light as aforesaid, and in case the company and the municipality do not agree, the said price and terms shall be determined by arbitration under this Act.

(a7) Upon an application in writing signed by not less than five ratepayers of the municipality the council of any municipality may, at its discretion, by by-law, permit the persons making such application to use the name of the municipal corporation for the purpose of taking proceedings to determine the price at which electric light shall by supplied to inhabitants of the municipality for domestic and other purposes ; provided that no such by-law shall be passed until the persons making such application have given satisfactory security to the council to indemnify the municipal corporation against all costs which may be incurred in the arbitration proceedings. After the passing of such by-law the said applicants may, in the name of the municipal corporation, name and give notice of an arbitrator to determine the price and terms of the contract for the supply of electric light or energy to the inhabitants of the municipality for domestic and all other lighting purposes ; and for the purposes in this paragraph set forth, the said applicants so acting in the name of the municipal corporation shall have the power to do all necessary things and take all necessary steps, and their acts shall be as binding upon the municipal corporation as if the said proceedings were taken by the municipal council thereof, and in case the company and the applicants so acting in the name of the municipal corporation do not agree, the said price shall be determined by arbitration under this Act. The municipal corporation shall have the right and is hereby authorized to take proceedings by arbitration in its own name for the purposes in this sub-section mentioned, and shall have all necessary powers for that purpose whether on its own motion or when used as in this sub-section is provided.

(a8) All the provisions of this section shall apply where an individual supplies electric light or electrical energy or gas or water for municipal and public purposes. In all such cases the municipal corporation and the individuals shall proceed hereunder

and be subject to the provisions hereof in the same manner as if the individuals were a company.

(a9) Any municipal corporation and company or individual may agree that the official arbitrators appointed under The Act respecting Municipal Arbitrations shall determine any matters in difference hereunder, and in such case his award shall be final and binding upon the parties as if such award had been made by arbitrators appointed under this Act.

2. Article (b) of the said sub-section 4 and sub-section (7) of section 569 of the said Act are hereby amended by adding at the end thereof respectively the following words: "Or the provisions contained in any contract now existing between any municipal corporation and any company."

(3) Articles (d) and (e) of the said sub-section 4 of section 566 are amended by adding the words: "Electric light" after the word "gas" wherever the latter word occurs in the said clauses, and by inserting after the words "supply pipe" in the seventh line the words "or wires."

(4). Sub-section 5 of section 569 of the said Act is hereby amended by inserting the words "electric light" after the word "gas" wherever the latter word occurs in the sub-section 5 of the title thereof.

(5) Nothing in this section contained shall apply to or affect any by-law now in force or which has, at the time of the passing of this section, come into effect, or contract heretofore made or entered into between a municipal corporation and any gas, electric light or water company; nor shall anything in this Act contained be deemed to prevent any contract being entered into hereafter between a municipal corporation and any such company or any by-law being passed by a municipal council not inconsistent with this Act in the same manner and for the same purpose and to the same extent as heretofore.

REGULATIONS OF THE PARIS EXPOSITION.

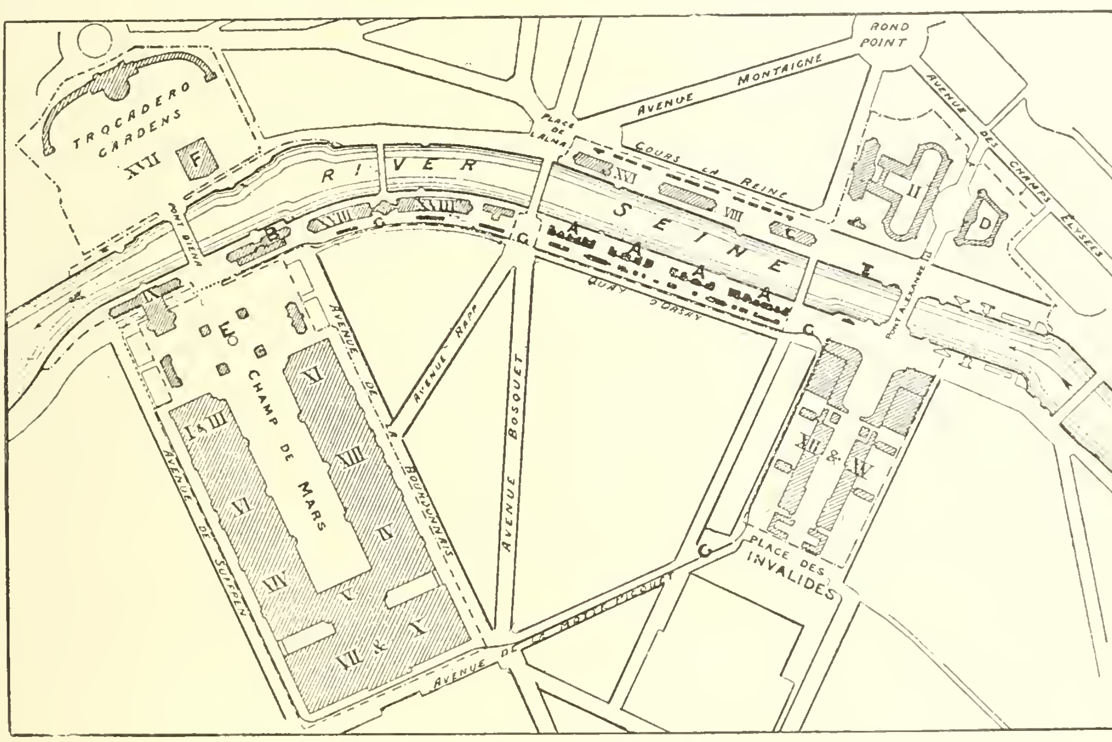
The Canadian Commission for the Paris Exposition of 1900 have issued a booklet giving regulations, classification of exhibits, and general information for intending exhibitors. The accompanying plan, which is herewith reproduced, shows the arrangement of the Exhibition grounds and buildings, and will no doubt be found of interest. The Exhibition will open on the 15th of April and close on the 5th of November. The Colonial building will be situated on the Trocadero grounds overlooking the Champs de Mars, not far from the Great Eiffel tower, and will cover 36,000 square feet, of which 27,100 feet has been allotted to Canada.

Forms of application for space must be returned to the Canadian Commission, Department of Agriculture, Ottawa, not later than June 1st, 1899. It is the desire of the Commission to secure the best possible exhibit of Canadian goods, and there will be no charge to exhibitors for space. Accepted exhibits from Quebec, Ontario and the west must be delivered at the exhibitor's expense at Montreal or Quebec not later than November 1st, 1899, and exhibits from the Maritime provinces at Halifax, N. S., not later than November 15th. These will be shipped to Paris by the Commission free of charge. Exhibitors are expected to dispose, in Paris, of their exhibits when these have a commercial value, as only valuable collections of objects of special character will be granted free return transportation. The exhibits are divided into eighteen groups, which are again subdivided into numerous classes.

Group four includes apparatus pertaining to mechanical engineering, and is divided into three classes, as follows:

Class 19.—Steam Engines: Fire boxes, furnaces, boiler chimneys; stationary, semi-portable or portable boilers; packings and boiler fittings; feed apparatus; steam jacketing anti-fouling compounds; water softening; feed water heaters, steam driers, superheaters; steam piping, joints, cocks, piping; stationary, semi-portable and portable engines; valve gear; condensers; regulators and governors; lubricators and fittings; engines set in motion by evaporation other than that of water; methods of testing and examining steam apparatus; associations of owners of steam plants.

Class 20.—Various Kinds of Engines: Engines worked by hot



PLAN OF EXHIBITION GROUNDS AND BUILDINGS—PARIS EXPOSITION.

WHEN WAS COAL FIRST USED AS FUEL.

The general opinion, according to the "German Pottery and Brickmaker's Gazette," has been that coal was first used as fuel about 700 years ago, at Leige, in Belgium, but the fact is it was employed for this purpose at a much earlier date. The discovery was made on German soil in the beginning of the 12th century that the mineral we call coal was good to burn. The place where it was first obtained is exactly known; it is the present Kohlenberg, in Wurmthal. In the ancient chronicles this place was called Kalkulen, the same thing as Kohlenkull; later it was called Koalberg.

At the present time the good people of the Wurmthal call a coal mine "Kull," and the coal miner is not called a miner, but a Kohler (coaler), the common name in other parts of Germany for a charcoal burner.

The City Council of Hamilton, Ont., have appointed Campbell Leckie as engineer of the sewage disposal works.

air, gas, petroleum, compressed or rarified air, ammonia, carbonic acid gas; parts and fittings of such engines; hydraulic motor, wheels, turbines, water pressure engines, etc; wind mills and wind motors; gins, tumblers, spring counterweight and pedal motors, etc.

Class 21.—General Machinery: Apparatus for the transmission of power; shafting, plummer guides and slides, jointed systems; gearing; clutches, pawls; pulleys, belting and cables for transmission of power; funicular systems; governors and speed regulators; lubricators; recording instruments, engine counters, recorders, speed indicators, dynamometers, pressure guages; weighing machines; machines for testing materials, apparatus for measuring fluids and gases; machines for moving loads; cranes, lifts, etc; machines for raising water; hand or steam pumps, norias, hydraulic rams; hydraulic presses and accumulators; water pipes and accessories; air compressors and piping; ventilators; power transmission and distribution at a distance by means of water, steam, air or vacuum; apparatus and associations for preventing accidents caused by machinery.

The exhibit of electrical apparatus is placed in group five, divided into five classes, as below:

Class 23.—Mechanical Production and Utilization of Electricity: Apparatus for generating electrical currents; continuous, alternate and polyphase current dynamos; transmission of power to a distance; continuous and alternate current motors; motors with rotating fields; alteration of currents; dynamo and alternate current transformers; application of electricity to transport purposes, electrical locomotives, electric tramways; application of electricity to mechanical purposes, such as elevators, winches, cranes, capstans, traversers, machine tools, magnetic warping; special methods of wiring; safety appliances and regulators.

Class 24.—Electro Chemistry: Batteries; accumulators; plant and processes generally used in electro-plating and electrotyping; production and refining of metals or alloys; application of electro chemistry to commercial purposes, such as bleaching, sugar refining, treatment of sewage water, manufacture of soda, chlorine, chlorine of potassium, etc.

Class 25.—Electric Lighting: Use of continuous or alternate currents; arc lamps; regulators; carbons for lighting purposes; incandescent lamps; special installations for factories, public buildings and private dwelling houses; central stations; application to light houses, navigation, military engineering, public works; safety and regulating apparatus; meters; photometry; appliances for determining the intensity, distribution and illuminating power of light; special electrical appliances, such as chandeliers, candelabra, ornaments, brackets, etc.

Class 26.—Telegraphy and Telephony: Telegraphic instruments; transmitters and receivers; multiplex instruments; multiplex telegraphy; various parts; relays; repeaters, lightning conductors; speaking instruments; telephones and microphones; telephone exchanges, bells, alarums, sounders; simultaneous telegraphy and telephony; wiring for telegraphs and telephones: overhead wires; subterranean and submarine cables.

Class 27.—Various Applications of Electricity: Scientific apparatus and measuring instruments; medical electricity; electric clock-work; application of electricity to railways, mines and public works; signals; exploders; distance indicators and recording apparatus for all kinds of phenomena; electric furnaces; electric welding; electric heating apparatus.

The Riordon Paper Mills Co. of Hawksbury, Ont., are lighting their plant throughout by electricity. An order has been placed with the Royal Electric Company of Montreal for one of their 25 K. W. S. K. C. two-phase generators, wound to deliver 110 volts. There will be 200 incandescent lamps installed from this throughout their mills as well as ten alternating inclosed arc lamps. This is the fifth large mill or factory, which has within the past year installed alternating current apparatus of the S. K. C. two-phase type in preference to direct current apparatus, which the alternating current in three cases replaced, and in two cases were new plants. It shows the trend toward alternating current apparatus for all purposes, and the prediction is heard that before many months we will have alternating current street railway apparatus in use in Canada. It is already extensively used in Europe, especially in Switzerland, and the larger companies in the United States are experimenting with it and have already built a new road entirely equipped with alternating current apparatus, which is said to be giving perfect satisfaction. We may therefore in the near future have the alternating current in use for factory lighting, central station or street railway apparatus.

BLINDNESS FROM THE ELECTRIC ARC.

THE danger to one's sight from the light of an electric arc, no matter whether produced for a useful purpose, or the result of some chance short circuit, should be clearly understood by every one, writes Prof. Arthur J. Rowland, in the American Electrician. This is especially true, in view of the many uses of electric arcs, besides those so familiar in the common 1,200 and 2,000 candle power arc lamps.

If one's line of vision takes in such an arc as that in the ordinary arc lamp, or that due to an accidental short circuit, or one at the break of a large current at high potential, the eye suffers a sort of paralysis, and on looking away one sees as through a fog. This effect soon passes away, and at worst requires a sojourn of a day or two in a dark room to produce a cure.

With arcs taking large currents, and especially if one electrode is metal, the effects are quite different and much more serious. At night one notices the intense brilliance and is on his guard. In daylight the contrast is not so great, and so one is more likely to suffer because of lack of care. After working with such arcs the eye does not immediately feel the effect; but after a time, perhaps hours afterward, a slight scratching is felt in the eye, as though there were some fine dust or cinders there. As time goes on, this is followed by a feeling of dryness on the eyeball, accompanied by a very profuse shedding of tears, and all the symptoms of a heavy cold in the head are felt. If the attack is a bad one, the pain becomes a very intense aching and may be accompanied by a twitching of the eyelids. In these worse attacks the afflicted one can bear no light on the eyeball, and if the eyes are opened finds he is blinded.

In case of slight attack a simple eyewash is all that is necessary for a cure. Use one made of six grains of borax in a fluid ounce of infusion of sassafras pith, or one of ten grains of boric acid in an ounce of camphor water. I can vouch for the first and have almost equal confidence in the second. In a very bad case a physician will apply cocaine, that local anæsthetic so commonly used in the eye. No one but a physician should do this.

After a few hours the pain passes away, and by keeping in a darkened room and then wearing smoked glasses for a couple of days, the eye wash being kept in use, all ill affects pass away, leaving the patient with a firm resolve to avoid further experience in this direction.

It is found that the effect of the arc has been to produce an external burn—like a sunburn—on the conjunctiva, or outer membrane covering the front of the eye-ball. If one protects the eyes, this "sunburn" from the arc affects the skin; and results precisely like those after a day's outing at the seashore in midsummer are experienced.

In protecting the eyes against the burning power of such arcs it is not sufficient to simply wear such glasses as are made for those who adjust and repair common arc lights. Far too much of the light gets around them. It is necessary to use a mask covering the whole face. Even if one thinks to protect himself from all direct rays, by holding his hand before his eyes for example, there will still be likelihood of his suffering to some extent. In this way one who stops to look on may suffer from an eye trouble, the cause for which he has quite overlooked.

PERSONAL.

Mr. F. Poste has recently taken the management of the Prescott Electric Light Co.

Mr. C. F. Sise, president of the Bell Telephone Co., of Canada, is at present enjoying a brief vacation.

Mr. W. H. Browne, general manager of the Royal Electric Co., Montreal, is spending a few weeks in the Southern States with the object of regaining his health which had become impaired by a severe cold.

The death is announced of Mr. F. B. Beckett, a well known engine builder of Hamilton. The late Mr. Beckett was also interested in the Hamilton, Ancaster and Brantford electric railway project.

Mr. J. M. Campbell, Presideut of the Gananoque Electric Light and Water Supply Co., who has been in British Columbia for the past year or two has returned to Gananoque, and will likely reside there in future.

A recent visitor in Toronto from the Pacific coast was Mr. H. Pim, the Vancouver representative of the Canadian General Electric Company. Mr. Pim came east upon one of his occasional visits to the head offices of his company. He reports a steadily increasing demand in the west for electrical apparatus.

Mr. John Inglis, of the firm of Inglis & Sons, engine manufacturers, Toronto, died suddenly in that city last week. The late Mr. Inglis came to Canada from Scotland forty seven years ago, and carried on business successively in Chippewa, Simcoe, Dundas, Guelph and Toronto. He had received the benefit of a thorough training in his native land and was recognized as being one of the most skilful men in the business. Three of his sons were associated with him in business.

Mr. E. B. Merrill, formerly lecturer in electricity at the Toronto Technical School, has recently returned from Great Britain, where he resided for upwards of two years. During the greater part of this period he was connected with the Siemens Bros. Co. He states that a number of underground electric railroads are projected in London, one of which, between one and two miles in length, is now under construction. The proposal has been made to substitute electricity for steam on the main lines of the underground railway system which has served the central part of the city for a number of years past. One of the principal objects in view in making this change is to get rid of the sulphurous fumes and soot which are the unpleasant accompaniments of the present system.

TRADE NOTES.

It is rumored that the Smith's Falls Electric Light Co., and the Smith's Falls Power Co., will be amalgamated.

We are advised by Mr. Edward Slade, electrical contractor and engineer, Quebec, that in future his business will be carried on under the name of The Slade Electric Co., with offices and show rooms at 137 John street.

A new descriptive and fully illustrated catalogue and price list has recently heen published by the Weston Electrical Instrument Co., of Newark, New Jersey, the well known manufacturers of standard recording instruments.

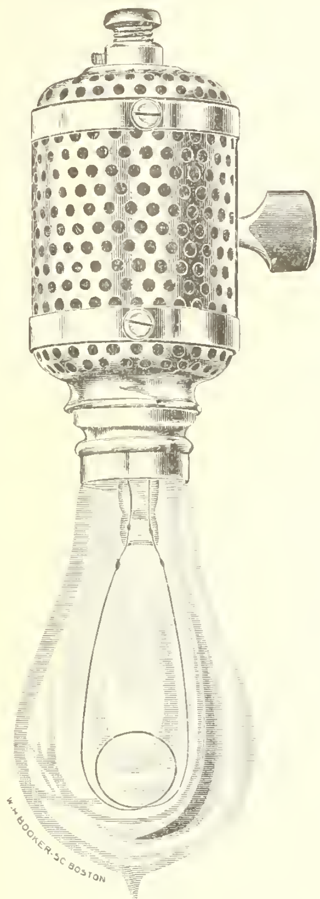
The corporation of the town of Joliette, Quebec, are extending their arc system and have placed their order with the Royal Electric Company for one of their 50 light 2000 c. p., T. H. royal arc machines with a full equipment of lamps. This is an addition to their recent purchase of an 120 k. w. S. K. C. generator with transformer, etc., which was started in operation two weeks ago.

The Consumers' Cordage Co., of Montreal, are fitting out their entire factories with electric power and have placed their order with the Royal Electric Co. for two 50 h.p. S. K. C. synchronous motors. The current for these motors is to be furnished by the Chambly Mfg. Company as soon as they have their current in the city, which is expected about the first of May.

The Esquimalt & Nanimo Railway Co., who are opening up their coal mines at Oyster Harbor, B. C., have decided to operate the entire mining and hauling apparatus by electricity, and for this purpose have placed their order for two direct connected units of 150 h.p. each, with Ideal engines and two 40 h.p. mining locomotives with switchboards and all the necessary supplies for the complete installation, with the Royal Electric Co., of Montreal. This is the second order that the Royal Electric Co. have received for mining locomotives and apparatus on Vancouver Island.

THE BRUNT REGULATING SOCKET.

The Packard Electric Company, of St. Catharines, Ont., in conjunction with their general agent in Montreal, Mr. R. E. T. Pringle, have recently placed upon the market the Brunt regulating socket, which they advertise to control an incandescent lamp in its radiation of light in the same manner as a gas jet is ordinarily controlled. The socket, illustrated herewith, admits of five conditions of light, with a positive saving, it is claimed, of current at the different stages, as specified below:



Brunt Regulating Socket.

Assuming a 16 candle 64 watt lamp is used, the first contact in the socket will give 16 candles at 64 watts; then by simply turning the key through an arc of 180 degrees, the light is diminished from 16 candles to 2 candles and the watts diminished from 64 watts to 27 watts; the intermediate stages of light consuming respectively 60, 52, 45, 37 and 31 watts. The socket is adapted to either direct or alternating current, the latter of any frequency; and it is also adapted to any voltage from 50 to 118. The construction of the socket renders it practically indestructible, being operated upon an entirely new principle.

These sockets have been found useful as night lamps in vestibules, hallways and sleeping apartments, and especially desirable for the sick room.

ELECTRIC LIGHTING AT WINNIPEG.

A tender was recently submitted to the city Council of Winnipeg by the Winnipeg Electric Street Railway company through H. J. Somerset, superintendent, for street lighting, at rates per light per night as follows: 10 years 175 to 250 lights, 29 cents each; 5 years, 150 to 200 lights, 34 cents; 5 years, 200 to 250 lights, 32 cents; 3 years, 150 to 200 lights, 39 cents; 3 years, 200 to 250 lights, 37½ cents. All lights to be 2,000 nominal candle power, each developing an electrical efficiency of 450 watts, and to be of the most recent type of lamps, such as the "Brush Improved," "Adams' Bagnall," or focusing lamps, as may be decided by the city, with the right only to use the lamps at present in use, so far as they are found in a satisfactory condition and subject to specifications, which will in every way meet the public requirements. Mr. Somerset wrote: "In order to bring the company's power house and generating system to a strictly up-to-date standard as the council are aware, the company is expending a large sum of money, and in order to establish the lighting system tendered for further large expenditure will be necessary and the company feel that with their modern system and facilities they are in a better position than the city would be for furnishing a satisfactory lighting service. It is the intention of the company to meet the views of the council in every reasonable way and if awarded the contract to furnish a first class service in every respect."

THE AMERICAN STOKER.

THE American stoker shown herewith offers the steam-using world a most thoroughly practical method for the economical use of coal.

Not only is a great saving effected in the actual amount of coal used, but the apparatus provides at the same time a practical and efficient means of smoke prevention. In this connection we show

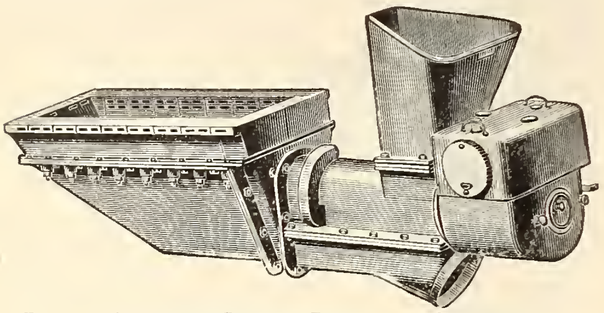


FIG. 1.—AMERICAN STOKER READY FOR INSTALLATION.

two views of the Dominion Cotton Company's mills at Montreal, that will be studied with interest by our readers.

Fig. 2 is a reproduction of a photogragh taken July 22nd, 1898, at 10 a.m. before the American stoker was put in, while Fig. 3 shows a view of the same chimney taken Sept. 9th following, at the same hour, with the whole of the steam plant of 700 h.p. in operation, the boilers fired by means of the American stokers using soft coal screenings.

These photographs were taken without the knowledge of any one connected with the cotton mill, and show in a striking manner how effectually the vexatious "smoke nuisance" question may be settled by the use of this type of mechanical stoker.

The principle upon which the American stoker operates practically reduces the coal to gas and coke and insures complete combustion. Immediately beneath the coal hopper, and communicating with it, is the conveyor pipe; this in turn communicating with the coal magazine. A screw conveyor or worm is located in the conveyor pipe and extends the entire length of the magazine. Immediately beneath the conveyor pipe is located the wind box, having an opening beneath the hopper. At this point is connected the piping for the air supply, furnished at low pressure by a volume blower. The other end of the wind box opens into the air space between the magazine and outer casing. The upper edge of the magazine is surrounded by tuyeres, or air blocks, these being provided with openings for the discharge of air, inwardly and outwardly. Each stoker is driven independently by a small steam motor, located immediately in front and beneath the hopper. The motor has a simple reciprocating piston. Its piston rod carries a crosshead, which, by means of suitable connecting links, operates a rocker arm having a pawl mechanism, which in turn actuates the ratchet wheel attached to the conveyor shaft. The stoker is thus entirely self-contained and complete in itself, and consequently there is no danger of the driving and feeding mechanism (the only working parts) ever getting out of alignment.

FIG. 2.—PHOTOGRAPH OF CHIMNEY BEFORE THE AMERICAN STOKER WAS INSTALLED.

The rate of feeding coal is controlled by the speed of the motor, this being effected by the simple means of throttling the steam in the supply pipe to the motor.

The shields covering the motor effectually protect the mechanism from dirt and dust.

The coal is fed into the hopper, carried by the conveyor into the magazine, which it fills, "overflows" on both sides, and spreads upon the sides of the grates.

The coal is fed slowly and continuously, and, approaching the fire in its upward course, it is slowly roasted and coked, and the gases released from it are taken up by the fresh air entering through the tuyeres, which explodes these gases and delivers the coal as coke on the grates above.

The continuous feeding gives a breathing motion to this coke bed, thus keeping it open and free for the circulation of air. Particular attention is called to the fact that every pound of coal fed into the hoppers passes through this gas-making process, and there is no loss of coal through grates, by reason of the use of dead grates in the furnace, in place of open grate bars.

The non-combustible is taken from the furnace in the shape of vitrified clinker. There is practically no soot, and with these results it is obvious that the combustion must be extraordinarily good.

The finest of slack coal can be used with the American stoker;

FIG. 3.—THE SAME CHIMNEY AFTER THE AMERICAN STOKER WAS INSTALLED.

it can also handle lump coal, as any lump that can be fed into the hoppers will be crushed by the conveyor, there being provided a set of teeth, placed at the mouth of the conveyor, against which the coal is squeezed and broken.

The American Stoker Company is located in the Washington Life Building, New York City. It has Canadian offices at 54 Street Railway Chambers, Montreal.

Since equipping the Dominion Cotton Co.'s mill, four other mills belonging to the same company have been equipped with the American stoker. In addition thereto the American Stoker Company have put their apparatus into a number of other prominent mills in Canada, among them being the British Columbia Sugar Refinery, St. Lawrence Sugar Refinery and one of the plants of the Canadian Pacific Railroad.

A large number of notable plants in the United States are now employing the American stoker. Further particulars with handsomely illustrated catalogue may be obtained by addressing the manufacturers.

The town council of Whitby has given a five years contract to the local electric light company for 27 arc lights at $1,000 a year. The council refused to entertain the request of some of the citizens to take tenders for the purchase of a civic plant.

For the first time in the history of the English Institution of Electrical Engineers a woman has been invited to read a paper at one of its meetings. Mrs. Ayrton, —the wife of Professor W. E. Ayrton, F. R. S., professor of applied physics in the Central Technical College of the City and Guilds of London Institute— has just read a paper on "The Hissing of the Electric Arc" at the meeting of that body. She has carried out a series of original investigations on the electric arc, and has contributed many papers on the subject.

SPARKS.

An electric plant is being installed in the Fort Saskatchewan Milling Co's. mill, N. W. T.

A scheme is mooted at Chilliwack, B. C., to purchase an electric light plant for lighting the town.

Mr. Geo. Stitt, of Cardinal, Ont., has invented a device to regulate the light of an incandescent lamp.

The Protestant School Commissioners of Montreal have decided to fit Mount Royal school with electric clocks.

The bill incorporating the Nova Scotia Electric Light Co., has reached an advanced stage in the Legislature.

The village of Nelson, B. C., is now in possession of its electric plant, having purchased it from the Electric Lighting Company.

The Canadian Water Power Company of Quebec, want a manager for their works now being constructed at Chaudiere Falls, near that city.

The annual meeting of the Amherstburg Electric Light, Heat and Power Company was held last month, at which the old officers were re-elected.

It is improbable that the proposed extension of the Ottawa Electric Railway from Rockliffe Park to the rifle range will be carried out this summer.

Mr. Saxby, of Kingsville, has submitted a proposition for electric lighting to the council of Bradford, Ont. He proposes to install a plant to cost about $8,000.

Mr. M. Martin has applied to the town council of Wallaceburg, Ont., for permission to erect poles and wires for the purpose of operating an incandescent lighting plant.

The city surveyor of Montreal has been requested to report on the feasibility of placing underground electric wires in Craig street from St. Lawrence to St. Antoine street.

The Anglo American Power Company, which was refused permission to lay underground wires in the city of Toronto, has asked for another conference with the Board of Control.

Mr. R. E. T. Pringle, Electrical Supplies, 216 St. James st., Montreal had his stock damaged somewhat by water during the fire which recently took place in Bett's restaurant, next door.

A by-law will probably be submitted to the ratepayers of Rat Portage, Ont., to raise the sum of $40,000 to purchase a half interest in the Citizens' Electric Light and Telephone Company.

On the 20th of this month the ratepayers of Winnipeg will vote on a by-law to install a municipal lighting plant. Tenders for the supply of the plant are invited by C. J. Brown, city clerk, up to the 17th inst.

The Pontiac Telephone Company are offering for sale their rights and plant, the line being about sixty miles in length. Tenders for purchase are to be addressed to F. C. Dezouche, Bryson, Que., by April 15th.

The Hamilton Electric Light and Power Co. are negotiating with the city of Hamilton for a renewal of its lighting contract. If given a ten years franchise, the company will spend about $100,000 in improving the system.

An arrangement seems likely to be made by the corporation of Gravenhurst for the purchase of the electric lighting plant now owned and operated in that town by Mr. Fletcher, who has offered to sell at the price of $10,500.

According to Mr. Hugh McCutcheon, Collector of Customs at Nakusy, B. C., a Toronto syndicate has purchased mineral springs near that place and intend building a $50,000 sanitorium, to be equipped with an electric light plant.

Frank Tushingham, an engineer at the power house of the Toronto Street Railway, recently had his left arm torn off at the elbow. Tushingham was repairing one of the pumps, when it started suddenly, resulting in the accident.

Buffalo capitalists are said to have decided to build an electric railway from Fort Erie, Ont., to Point Abino, a distance of thirteen miles, and to Chippewa, from which point an electric road runs along the Canadian side of the river to Queenston.

Mr. S. R. Ickes, of Harrisburg, Penn., was in Woodstock, Ont., recently, negotiating with the Council and Board of Trade regarding the construction of an electric railway to connect that city and Ingersoll. He proposes to locate the power house at Beachville, about midway between the two places.

News has reached Toronto that the city council of Birmingham, Eng., have decided, by a vote of sixty to one, to take over the street railway at the expiration of the Mackenzie-Ross franchise and operate it as a department of the municipal service. Mr. Granville C. Cunningham, formerly city engineer of Toronto, is manager of this road, which a few years ago was converted into an electric system.

Mr. E. A. C. Pew, is again to the front with his proposed power canal scheme. He states that the necessary capital has been subscribed for its construction and that the contracts will be let at an early date. The canal is intended to extend from the Welland river, two and one half miles below Wellandport, to the Jordon river, the power to be developed at what is called Ball's Falls.

The West Kootenay Power and Light Co., of Rossland, B. C., are experiencing a large demand for light and power. They are at present lighting up the shaft of several large mining properties, and are operating with complete success one of the largest electrical hoists ever installed. The hoist is designed to lift 12,000 lbs. at a speed of 800 feet a minute, and is driven by a 300 h. p. induction motor.

An engineer named Germain, in the French ministry of Posts and Telegraphs, has brought out an invention which he claims will revolutionize the telephone. By an ingenious adaptation of the telephone wire, the microphone is made to develop and intensify the vibration received, so that conversation can be carried on between two persons, both of whom may be several yards distance from the instrument.

The St. John Street Railway Company has been ordered by the court to pay $25,000 as damages to Professor Hesse. The professor was organist of the Roman Catholic Cathedral in Providence, R. I., and received injuries while a passenger on a car of defendants which necessitated the amputation of his left foot, and rendered him incapable of performing his duties as organist. The Street Railway Company will probably appeal the case.

According to the statistics issued by the Treasury Department of the United States, there were imported into Canada from that country during the fiscal year ending June 30th, 1898, electrical apparatus and instruments to the value of $300,530. Of this sum Nova Scotia and New Brunswick were represented by $24,566, Quebec and Ontario by $254,182 and British Columbia by $21,482. the total exports of electrical apparatus from the United States for that period were $2,770,803.

A bill passed the Ontario Legislature at the recent session containing an agreement between the corporation of the town of Peterboro and the Peterboro Electric Light and Power Co. The bill provides that the town may supply electric light and heat for municipal purposes only and power for all purposes except commercial and private lighting, and should it engage in these undertakings, it must purchase by agreement or arbitration the street lighting plant of the company.

The Metropolitian Electric Co., of North Toronto, are building a first-class power station of 1,000 h.p. capacity at Bond Lake, to supply current for the operation of that portion of their system now under construction, extending from Richmond Hill to Roach's Point on Lake Simcoe, as well as the proposed new line under survey to Schomberg and Tottingham. The company propose to establish picnic and camp grounds at Bond Lake, for which object they have purchased two hundred acres of land.

It is definitely announced that the Trenton Electric Company and the Trenton Water Company have amalgamated, under the name of the Trenton Electric and Water Company, Limited. An arrangement has been entered into with the town of Trenton whereby the new company is given entire control of the town's water power, including the privilege of transmitting power to outside points. The new company will proceed at once to construct a transmission line to Belleville, and intend doing their own construction work.

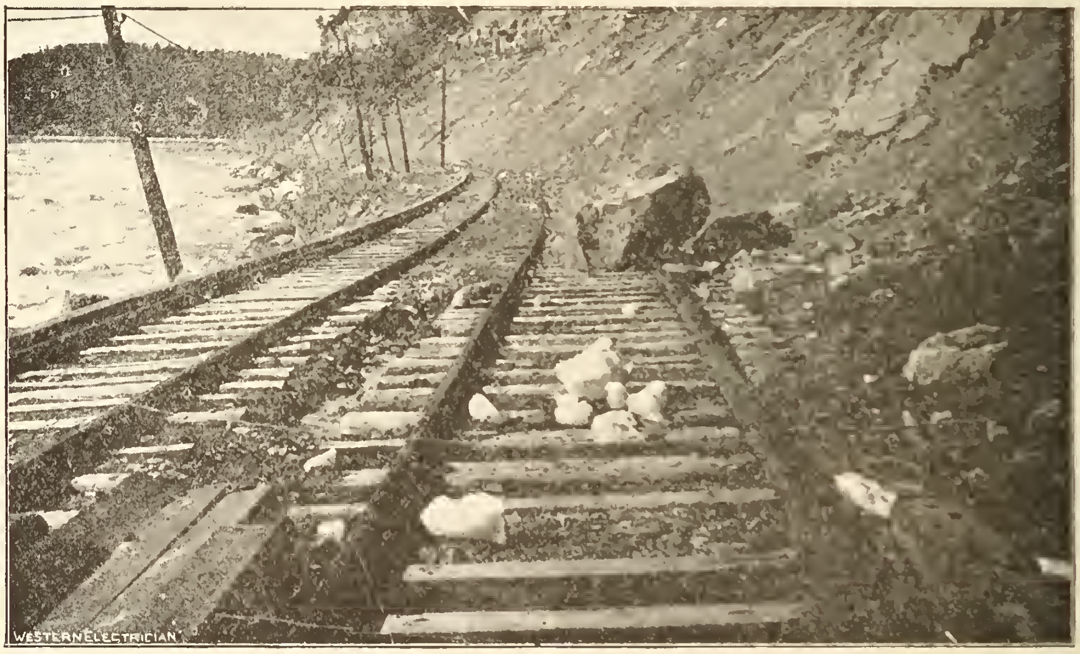
Mr. Chas. Brent, M. E., of the Rat Portage Metallurgical Works, has recently pointed out the fact that electric power might advantageously be supplied to and employed by the mines located within a radius of twenty-five miles of the water power at Rat Portage. He points out that in winter especially electric hoists possess a distinct advantage over steam hoists, as the use of steam when the thermometor is 40 degrees below zero is attended with many difficulties. This also applies to diamond drill work both on surface and underground. Mr. Brent estimates that electric power can be supplied at less expense than for plant, and at half the cost of steam power. In this connection the Rat Portage Reduction Works are being equipped with motors to which current will be supplied at a cost of $8 per day of twenty four hours for 75 h. p.

ELECTRIC RAILWAY DEPARTMENT.

THE NIAGARA GORGE ROAD.

THE accompanying illustration shows the present condition of the Gorge electric railway at Niagara, which recently passed into the hands of a receiver. The expense of maintaining the road in running condition, coupled with the shortness of the season during which a paying traffic might be counted upon, were the chief causes which brought failure to the enterprise. It is reported that the road will pass into the hands of the syndicate which is said to have recently secured control of the Buffalo street railway and the electric railway lines tributary to that city, including the Niagara Falls Park and River Railway.

Doubtless the promoters of this deal have in view the great exhibition which is to be held in Buffalo two years hence, which should provide a tremendous business for these electric roads and make handsome profits for the owners. The Gorge road could no doubt be made to pay as a part of such a system, but a considerable expenditure must be incurred if the lives of passengers are to be safeguarded. Some means is required of protecting the roadbed, cars and passengers from the masses of rock which are constantly loosening and tumbling down from the embankment, as shown in the illustration.



THE NIAGARA GORGE ROAD.

A NEW ELECTRIC RAILROAD AT QUEBEC.

THE line of railway between Quebec and St. Anne de Beaupre (the seat of the celebrated religious shrine visited yearly by thousands of pilgrims), which has hitherto been operated by steam, is to be transformed into an electric road. A contract has been given to Messrs. Ahearn & Soper, of Ottawa, for the necessary equipment.

The generating apparatus consists of one 600 k.w. AC. DC. Westinghouse generator, two 300 k.w. Westinghouse self-cooling step-up transformers, complete switchboard for generating station, one 200 k.w. Westinghouse rotary transformer, two self-cooling transformers, complete sub-station switchboard. Also 25 cars, which will be manufactured at Ahearn & Soper's car works. Some of the cars will be equipped with 12-A 30 h.p. Westinghouse motors, and some with 38-B 50 h.p. Westinghouse motors. The long cars, which will be used between Quebec and St. Anne de Beaupre, will each be equipped with four Westinghouse 50 h.p. motors.

AN UNDERGROUND ELECTRIC RAILWAY.

A CORRESPONDENT of the Toronto Globe thus describes an electric trolley line which he discovered in operation in a British Columbia mine: "On the other side of the shaft is the electric trolley, which is gradually displacing, though it cannot entirely supersede, the ubiquitous mule. The track is three miles in length and the accommodation not as enticing as that provided by the Toronto Railway Company. It would compare unfavorably even with the style of Sir Frank's regime, but what it lacks in display it makes up in speed. A bag of shavings on the bottom of a rattling, jolting, roaring and rocking box car makes an excellent seat. The guide has similar accommodation in the car behind, and then comes a long train of noisy empties. Beyond the three empties in front is the engine, lit by an incandescent globe and the light in the motorman's hat. Sometimes it disappears around a sharp curve, but the rattling, jolting cars chase after and bring it into view. The great weight of rock above is sustained by a succession of upright and cross timbers, making a continuous arch above the rushing train. Sometimes the timbers, which seem to be flying past overhead, descend close to the top of the engine and the motorman lowers his head for safety. An electric shock threatens the head that rises against the wire, and a more substantial shock is awaiting the head that rises anywhere else. But without any printed warnings to passengers both heads and arms are kept out of danger. Speed slackens, the arch grows wider, the cars jolt over a switch and come to a standstill. It is the siding where the returning train of full cars must be passed, and already the

rumble of them can be heard. The guide comes forward with the caution to look out for the overhead wire, and explains that we are almost directly under the big sailing ship we saw in the harbor loading coal. Between us and the vessel's keel is 600 feet of rock and 30 feet of water. The engine comes into sight around a curve, and whirls rapidly past with a long train of loaded cars for the shaft. When the track is cleared the guide returns to his bag of shavings and the deafening rattle of the empty cars is resumed."

ELECTRIC TRAMWAYS IN THE LAKE ST. JOHN REGION.

In a report submitted to the Department of Woods and Forests of the Province of Quebec, Mr. J. C. Langelier points out the immense possibilities of the Lake St. John region for the manufacture of pulp and paper. The development of this industry will, he thinks, result in the construction of electric tramways, concerning the outlook for which he says:

"There is probably no other place where electric railways could be built under such exceptionally advantageous conditions. In addition to the fact that the ground is level and building timber right on the spot, there would be all along the line, at comparatively short intervals, water powers capable of giving an unlimited supply of electricity. Starting from the west there are the Mistassini falls, and a mile further those of the Mistassibi; nine or ten miles further to the east the White Falls on the Little Peribonca; nine or ten miles still further east, the falls of the Great Peribonca. From these falls to those of the Little Discharge, there is a distance of less than twenty miles. At the same distance from the Little Discharge are the falls of the au Sable river, 249 feet high. Six miles further and a dozen miles from St. Alphonse is the Chicoutimi river, which could also supply power for producing electricity.

It would be equally easy to establish an electric line between Mistassini and Roberval, the western terminus of the Quebec and Lake St. John Railway. From Mistassini to the Chamouchouan, there is barely more than sixteen miles, and about midway the Tecouapee river could supply water-powers capable of providing an abundance of electric power.

On the Chamouchouan the Bear falls could be utilized for the same purpose. From the Bear fills to Roberval, a distance of about 30 miles, the Salmon, Iroquois and Ouiatchouaniche rivers, nearly at equal distance from one another, also have water-powers capable of supplying the electric power required for a tramway.

The construction of an electric tramway between Montreal and Roberval, a distance of about 250 miles could be effected under the most favorable conditions. The summit to be got over or the difference of level between the two places is about 725 feet instead of 1,300, and even more on the Quebec and Lake St. John Railway. There would only be two bridges at all costly, those of the rivers des Prairies and St. Maurice.

From Bou de l'Ile to the river Mastigouche, a distance of about fifty miles, there would be only the water-power obtained by damming the river L'Assomption for producing electricity by hydraulic power; but from Mastigouche, whose rapids and cascades could develop considerable motive-power, there are the falls of the river a la Chienne, one 200 feet, the other 75 feet high, the rapids of the Pabelognang and of the Vermilion, whose course is nothing but a series of cascades and falls; beyond the St. Maurice are the falls of the river Trenche, six miles from its mouth; those of the river Croche, those of the river Ouiatchouaniche, which falls into Lake St. John at Roberval village. Finally, from the Mastigouche, a distance of a couple of hundred miles, water-powers capable of supplying an electric railway are not at greater distance from one another than 25 miles, so that there is no place where the current would have to be transmitted more than 25 miles.

The traffic supplied by the paper mills would suffice to assure the success of such a railway, but there will also be many other sources, as it would serve to supply the great lumbering establishments on the Upper St. Maurice. It would likewise develop the settlements in the valley of the Mattawan, especially in the rich and fertile territory between the rivers Trenche and Croche, where there are nearly a million acres of the best farming lands, with a climate more favorable for farming operations than that of the neighborhood of Three Rivers."

McGILL UNIVERSITY NOTES.

The sessional lectures at McGill University have been finished, and examinations are now being held.

A considerable quantity of apparatus for the new equipment of the Department of Electrical Engineering of McGill University has been received during the past month.

The installation of a new electric elevator in the Engineering Building of McGill University is being considered. The building will also be entirely re-wired during the summer.

Professor R. B. Owens lectured before the Natural History Society of Montreal on the evening of March 30th, on the subject of "Water Power Development." Professor Owens leaves for England about the end of the present month, and will return before the commencement of lectures in the fall.

SPARKS.

The electric car shops at Ottawa were recently damaged by fire to the extent of $12,000.

It is reported that a company is being formed to introduce electric vehicles in Vancouver.

The Chicoutimi Water and Electric Co. are applying for a charter, with a capital stock of $125,000.

Incorporation has been granted to The Electric Boiler Compound Co., Limited, of Guelph, capital $15,000.

Mr. S. W. Bradley, formerly of the Hull Electric Railway, is the new manager of the Cornwall Electric Street Railway.

Mr. Thomas Potter, electrician, of Walkerton, recently received a severe shock by accidental contact with a live wire.

Negotiations are said to be in progress for the purchase by an English syndicate of the Belleville Electric Railway. If the deal goes through the road will probably be extended.

It is announced that the Eugene Munsell Co., of New York, are about to establish at Ottawa extensive works for preparing mica for a variety of purposes.

Mr. Frank Postlethwaite, electrical and mechanical engineer, died in Toronto a week ago from consumption. He was a graduate of Illinois University.

The corporation of Orillia have agreed to accept water wheels manufactured by the Jenckes Machine Co., of Sherbrooke, to generate current for the proposed long distance electric transmission system.

Ald. Morris recently questioned the quality of the light supplied by the Ottawa Electric Co. The company claim that there has been no deterioration in the quality.

A bill has passed the Ontario Legislature incorporating a company to construct an electric railroad from Smith's Falls by way of Gananoque to Merrickville.

Prof. J. T. Nicholson, whose paper before the Institution of Civil Engineers on the temperature within the cylinder of the steam engine, attracted widespread attention a year ago, has resigned his position as head of the Mechanical Engineering Department of McGill University. Prof. Nicholson has been appointed to take charge of the Mechanical and Engineering Department at the new Municipal Technical School, Manchester, England.

Professor R. B. Owens has reported favorably on the plans of the Metropolitan Electric Co., for the development and transmission of electric power to the city of Ottawa. His report states: "From an engineering standpoint you have a power exceptionally easy of development, and its electrical transmission and distribution to and in the city of Ottawa presents no particular difficulties, and can be cheaply and efficiently done as compared with other similar plants now in operation. Considering the short length of line and the probable mixed nature of the load, consisting of both lights and motors, two phase distribution is probably advisable." The contract for the development works at Brittania has been awarded to Messrs. Brewder & McNaughton, of Ottawa. The work is to be completed by the 15th of November next.

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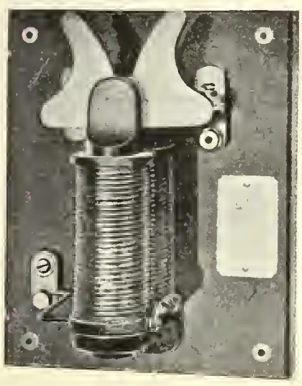

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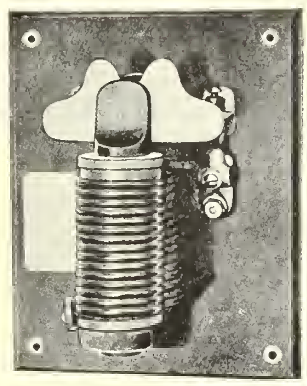

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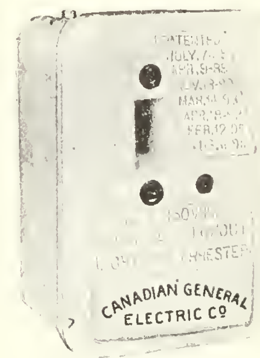

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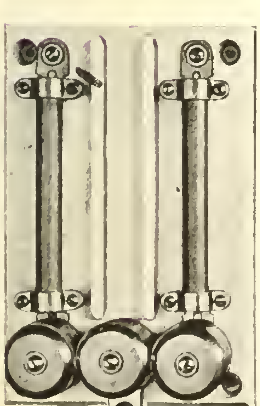

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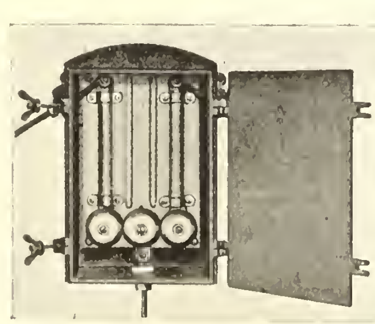
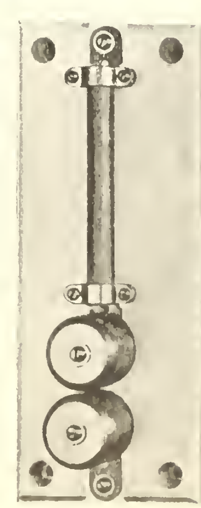


GE ALTERNATING CURRENT ARRESTERS.



SPARKS.

The council of Blenheim, Ont., are considering an extension of the electric light system.

Incorporation is being sought for the St. Croix Water Power Co., to store water in the St. Croix river and its tributaries.

The Goldie & McCulloch Co., of Galt, have the contract for a new engine for the Electric Light Works, at Fort William, Ont.

Wm. Quinn, of Lindsay, has been appointed manager of the Bell Telephone Company branches at Port Hope and Cobourg.

A committee of the council of Almonte has been appointed to learn on what terms the town could purchase the plant of the Electric Light Co.

Tenders are being invited for the construction of the dam for the new electric light plant which is to supply the towns of Liverpool and Milton, Nova Scotia.

The Ottawa Electric Company have undertaken extensive improvements to their plant at the Chaudiere. A large addition wiil be placed to the south side of the power house, and in this building heavy machinery will be placed. It will be necessary to do a large amount of blasting in order to make a foundation for the new apartments, and it is estimated that upwards of 5,000 cubic yards of rock will be taken out. A new flume will also be built, extending from the west side of Bridge street and emptying into the old waterway which runs into the Ottawa river. The flume which will be 20 feet wide, will be closed in on the north side by a cut of solid rock and on the south side by an immense stone wall. It is expected that by the company's method of controlling the water flowing into the flume, anchor ice will be entirely done away with.

This Number Contains a Complete Report of the Recent Convention of the Maritime Electrical Association.

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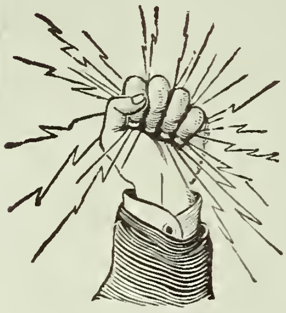

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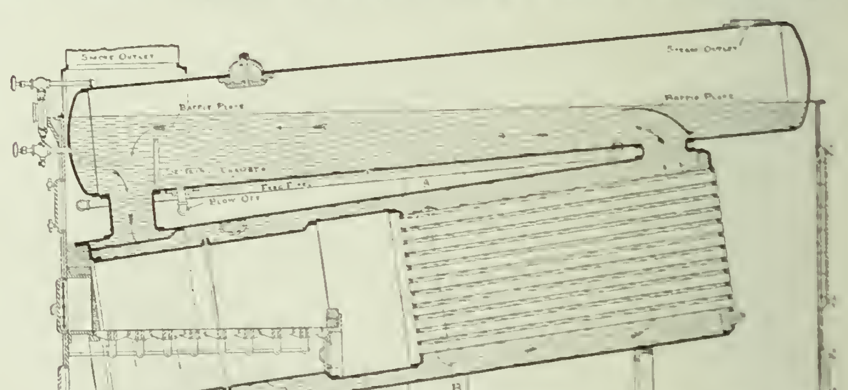

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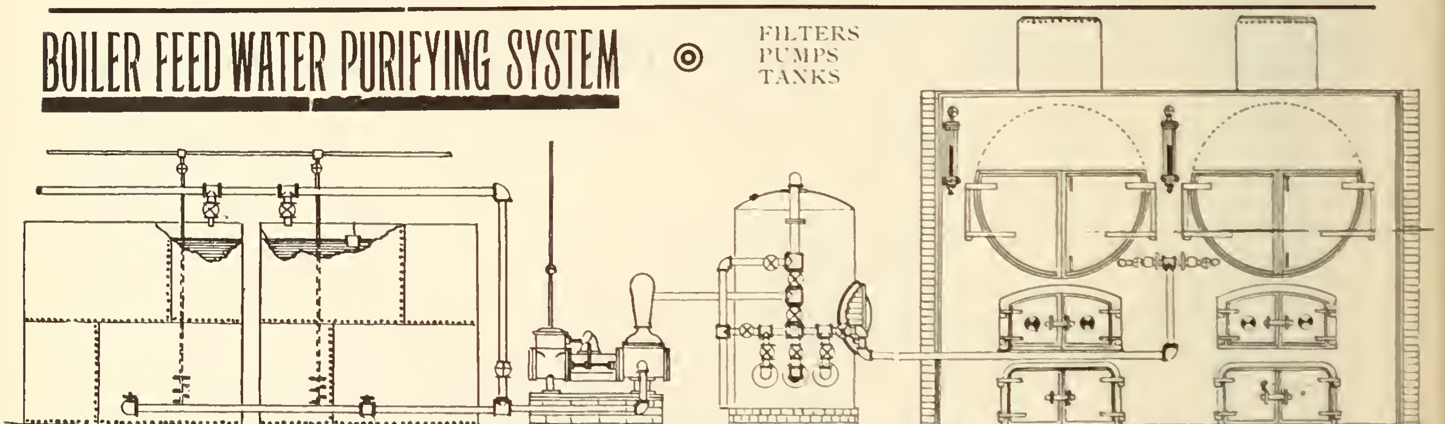

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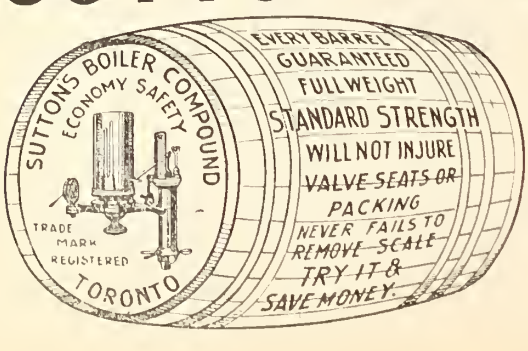

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ELECTRICAL NEWS

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STEAM ENGINEERING JOURNAL.

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MARITIME ELECTRICAL ASSOCIATION

Proceedings of the Second Annual Convention

THE second annual convention of the Maritime Electrical Association was held, pursuant to announcement, at the New Victoria Hotel, Halifax, on Tuesday, April 18th. The Executive Committee met at 9 a.m. to transact business relative to the admittance of new members to the Association and its financial condition.

The opening session of the convention was held at 10 a.m., with the President, Mr. F. A. Bowman, in the chair. There were present the following members:

F. A. Bowman, superintendent New Glasgow Electric Co., New Glasgow; J. H. Winfield, eastern superintendent N.S. Telephone Co., New Glasgow; G. N. McDonald, electrician, Moncton, N. B.; S. G. Chambers, president Chambers Electric Light & Power Company, Truro; P. R. Colpitt, city electrician, Halifax; F. A. Huntress, manager Halifax Tramway Co.; J. W. Crosby, electrician Halifax Tramway Co.; I. H. Smith, representative Canadian General Electric Co., Halifax; G. C. Siebert, Maritime Electric Co., Halifax; R. T. MacKeen, representative Halifax Tramway Co.; F. A. Hamilton, electrical engineer, Halifax; W. Luke, Halifax Tramway Co.; P. A. Freeman, chief engineer Halifax Tramway Co.; James Graham, electrical contractor, Halifax; C. E. Harris, manager N.S. Telephone Co., Halifax; J. D. Briggs, superintendent N.S. Telephone Co., Halifax; A. Miller, electric light inspector, Halifax; E. Souliss, Bedford Electric Co., Halifax; J. A. Anderson, electrician John Starr, Son & Co., Halifax; W. N. Pickles, electrical contractor, Halifax; J. L. MacDonald, Halifax Tramway Co.; W. A. Winfield, Windsor, N.S.; H. P. Archibald, B.A.Sc., Wolfville, N.S.; W. L. MacDonald, Moncton, N.B.

MR. F. A. HUNTRESS,
President Maritime Electrical Association.

After a few opening remarks, the President called upon the Secretary to read the minutes of the last meeting, held in Halifax September 27th, 1898. Upon motion the minutes were adopted.

The President then delivered his annual address, as follows:

PRESIDENT'S ADDRESS.

We have now passed through the first year of our existence, and have found out what are our powers and what our limitations. We held a convention during exhibition week last September, which was a fairly successful one, and would have been much more so had not the weather interfered with it, as it did with pretty much all arrangements of that week. In spite of this, one of the objects of the Association was distinctly advanced by the meeting. Several of the out of town members made the acquaintance of each other and the town members.

One feature of this meeting was most valuable, and will, I hope, be repeated this time. Several matters were brought up and discussed that were of direct interest to the members present, and personal experiences on these were freely exchanged. With a view to encouraging this, we issued a circular to the members, asking if there were any questions that they would like to bring forward. The response to this request was not as full as I would like to have seen, but we must not expect too much at first. We have a few questions that will be introduced for discussion as opportunity arises, and I hope that some of those who did not answer the circulars have brought questions with them, and will bring them up for discussion.

It is the discussion of the smaller and more local issues that I wish to encourage in this Association. As I think I have said before, we can depend on the larger associations and the technical journals to furnish us with valuable papers on the main principles of the industry. We should, therefore, devote our attention more to smaller details. The best way to do this is to get the members to feel that they can bring up any subject on which they want information and advice. As with our comparatively small numbers we shall very soon be all personally known to each other, our meetings should not take on a too stiff and formal aspect, but each one should feel at home and as free to say much or little as they would in a group gathered in the hotel smoking room. I will, therefore, ask you, one and all, to note any difficulties you may meet with or special methods you may use in your work, and either write them out in a few words and present them at a meeting, or, if you are really too diffident to do this, write a note to the Secretary and give him the idea, and it will be brought up at the meeting, with your name mentioned or not, as you may wish. I spoke at some length on this matter at the September meeting, and I must plead as my excuse for repeating it now its vital importance to the welfare, not to say the actual continued existence, of the Association.

The executive and the Halifax members have striven to make this meeting a thorough success, and it is hoped that it will result in awakening a thorough interest in the Association throughout the maritime provinces. I wish right here to thank the Halifax members for the lively interest they have taken, and the strenuous efforts they have made to make everything pleasant and attractive. Under the able leadership of our Vice-President, Mr. Colpitt, they have prepared a programme of papers and social entertainment that should cause this meeting to be long remembered.

Steady progress has been made in the electrical industries in these provinces during the past year. While we cannot expect to see the very large transmission schemes undertaken among us just at present, some smaller ones have been well worked out on modern lines, and some steps have been taken in connection with larger projects. All this going to show that our people have grasped the great possibilities of electrical power.

Among the many steps in advance that the industry has made during the past year, one that should be most seriously studied by the smaller stations is the question of forced draft in the

furnaces. While this matter has been coming steadily to the front for some years, it has lately been pushing itself into notice most markedly. Some remarks on this subject were made at our meeting last September that showed that our members were studying the subject and stand ready to adopt new ideas when it becomes apparent that they will pay. I hope that further information may be brought out at this meeting from those who have had practical experience in this matter or who have given it study.

F. A. BOWMAN, President.

Mr. Hamilton expressed his pleasure in listening to so able an address. In the course of his remarks he

MR. P. R. COLPITT,
Vice-President Maritime Electrical Association.

also stated that the suggestions made by the President were good. After some fitting remarks upon the zeal and untiring efforts displayed by the President during his term of office, Mr. Hamilton moved that a vote of thanks be tendered Mr. Bowman. This was seconded by Mr. Colpitt and heartily approved of by the members.

The President, replying, expressed his thanks to the meeting. He felt that he had done what he could, being hampered to a large extent in his duties on account of living at such a distance from the majority of the members. In the course of his remarks he again referred to the advisability of electing the members resident in Halifax to the offices of president, vice-president and secretary, also suggesting that a sufficient number of Halifax members be elected to the executive committee that a quorum could be formed at short notice, if necessary, without difficulty.

The Secretary then read his report, as follows :

REPORT OF SECRETARY-TREASURER.

At the meeting of organization held last April in Halifax, we had the names of fifty-six persons who were interested in the formation of this Association and had expressed their wish to become members. That meeting was a success, and the prospects seemed good for the formation of a very useful society. Since that time every effort has been put forth by the officers to further increase the membership list, though apparently with not any great degree of success. Circulars of information have been sent to all persons in the province (whose names we could obtain) that were eligible for membership. Only three new members have been added during the year, but we trust that our efforts have at any rate broken the ground, and that the fruits of our labors will appear later. Two meetings of the Executive Committee were held during the year, and various plans were discussed for rendering the Association of as much value as possible to its members. The following statement will show the financial condition of the Association at the close of the year, March 31st, 1899:

RECEIPTS.

46 membership fees at $2	$92.00

EXPENDITURE.

Rent of room for meeting, April, 1898	$ 5.00
Books, etc., for Secretary	4.35
Membership certificates	6.20
Printing	34.50
Rent of room for meeting, September, 1898	5.00
75 copies of report of meeting, September, 1898	3.75
Expressage and telephone	1.50
Postage	10.00
Cash in hand	21.70
	$92.00

The total membership list at the close of the year was 59. There were four new members elected at the executive meeting this morning, bringing the number up to 63. There are thirteen fees for last year still remaining unpaid.

J. H. WINFIELD,
Secretary-Treasurer.

Mr. Anderson moved, seconded by Mr. Chambers, that the report be adopted, which was carried.

A short time was then devoted to a general discussion as to the standing and financial condition of the Association, the general opinion being that, although the record of the Association during the past year had not been particularly bright, yet the present year promised better success.

The election of officers for the ensuing year was then proceeded with.

For the office of President, Mr. Chambers nominated Mr. P. R. Colpitt, of Halifax, the retiring vice-president.

Mr. Colpitt, however, feeling that it would be impossible for him to accept the position, nominated Mr. F. A. Huntress, of Halifax, for the office. This was seconded by Mr. Anderson, and met with the universal approval of the members.

For the office of Vice-President, Mr. R. T. MacKeen moved, seconded by Mr. Chambers, that Mr. Colpitt retain his office as Vice-President. This motion also met with the approval of the members.

Mr. Chambers nominated Mr. Irving Smith, of Halifax, as Secretary-Treasurer.

Mr. Smith declining the nomination, Mr. Chambers

MR. R. T. MACKEEN,
Secretary-Treasurer Maritime Electrical Association.

nominated Mr. R. T. MacKeen, who was elected to the office.

The following members were then elected to the Executive Committee : Messrs. Hial Brown, St. John, N. B.; J. Eddington, Moncton, N.B.; J. A. Waddell, Charlottetown, P.E.I.; S. G. Chambers, Truro, N.S.; W. Pickles, Irving Smith, J. A. Anderson, and F. A. Hamilton, Halifax.

Mr. Miller moved that a vote of thanks be tendered

to Mr. J. H. Winfield, the retiring Secretary-Treasurer. This was seconded and carried unanimously.

Mr. Winfield expressed his gratitude to the members for their token of regard. In the course of his remarks he referred to the suggestion made by Mr. Bowman in regard to the difficulty experienced by the officers in fulfilling their respective duties, owing to their living at such a distance from the majority of the members. He thought that for the first few years the principal officers, at least, should be so located that they would be in touch with most of the members, thus increasing their opportunities for developing the Association.

It was then moved and carried that the selection of place and date of next meeting be left to the newly-elected Executive Committee.

Upon motion of Mr. Hamilton, seconded by Mr. Miller, the meeting adjourned until the afternoon.

AFTERNOON SESSION.

The afternoon session opened at 3 p.m., with the Vice-President in the chair. A few moments were devoted to completing the business of the morning. The President then invited Mr. P. R. Colpitt to read his paper on fire alarm telegraph systems, which was as follows:

THE EVOLUTION OF THE FIRE ALARM TELEGRAPH.

By P. R. Colpitt.

In submitting a paper on the above subject, I propose to briefly describe the system as it is to-day, and the various stages of improvement that led to its present stage of perfection.

Until 1850 (a period within the memory of some of the members of this Association) electric fire alarms were unknown. In the largest cities there was no means for arousing firemen and citizens except the primitive method of shouting and ringing bells or sounding steam whistles—which still prevails in most of our towns. In New York as early as 1845 the city was divided into districts, in each of which a watch tower was erected where a watchman was on duty at all hours. The districts were numbered, and when a watchman discovered a fire by seeing the smoke or flame, or a fire was reported to him, he would strike upon his bell the number of the district. This was heard by the watchman on the next tower and by him repeated, and in that way the alarm was gradually announced all over the city.

The first suggestion for the use of the telegraph for fire alarms was made by Dr. W. F. Channing, of Boston, directly after the earliest telegraph experiments of Prof. Morse in 1839. In 1845 Dr. Channing published an article in the "Boston Advertiser" describing a method for the application of the telegraph for giving alarms of fire. In 1851 he managed to interest the city council of Boston in his scheme to the extent that $10,000 was appropriated for an experiment. Dr. Channing's plan was to establish numerous box stations over the city connected by telegraph circuits with a central station from which signals received from boxes were sent out over other circuits to the bell towers—the signal was thus simultaneously struck on every fire-bell in the city by electric mechanism. At about this time Dr. Channing associated himself with Moses G. Farmer, who was a recognized expert electrical mechanic of that day, and Mr. Farmer worked out practically the machinery necessary to complete the inventions made either by Dr. Channing or by Channing and Farmer jointly. Mr. Farmer constructed the Boston system and had charge of it for several years. Messrs. Channing and Farmer took out many patents which were the foundation of the fire alarm system as it exists to-day.

In 1855 John M. Gamewell purchased the Channing and Farmer patents for the Southern States, and four years later acquired the patents for the rest of the country. This was the beginning of the well known Gamewell Fire Alarm Telegraph Company and of the several companies now manufacturing fire alarm and police signal apparatus. The Gamewell concern is probably the best known because of its greater age. All fire alarm telegraph systems, as far as the writer's knowledge goes, embody the fundamental principles of the early Channing patents, so that a description of one will serve for all as far as general principle goes. Any difference or improvement that one may have over the other is in arrangement of detail.

DESCRIPTION.

A fire alarm telegraph system consists of a central station provided with closed circuit batteries or other course of electrical energy, switch-board, automatic repeater and other instruments for regulating and controlling the system, wire circuits for connecting the central station with the street signal boxes, and alarm apparatus consisting of electro-mechanical bell checkers, electro-mechanical gong strikers, located in engine houses or residences of fire department officials, and visual indicators showing in plain figures the number of the signal box from which an alarm originates. The system is a closed circuit one, and any interruption of the circuit will release all the armatures of magnets, causing the bells to strike. To get any signal number, therefore, it is obviously only necessary to have mechanism to open and close the circuit a pre-determined number of times. This is accomplished in the signal boxes in the following manner:

A break wheel is provided with radial projections on its face to correspond with the number of signal required. Two German silver contact springs are so placed that they come in contact with the projections on the break wheel, thus opening and closing the circuit as the wheel revolves. In the first boxes this break wheel was operated by hand by turning a crank, one revolution of which would give the complete number. I am not in a position to tell how successful this style of box was, but am under the impression that the average man to-day under the excitement of having his property burning would turn that crank so fast that the armature would scarcely have time to release in a complete revolution. The modern boxes, however, are provided with clock work, the propelling power being a spring, so that simply releasing a dentin by pulling a hook is all that is necessary to set the clock work in motion.

A difficulty arose in the first boxes, in that there was nothing to prevent alarms from being pulled in from different boxes simultaneously, thus causing a mix up in signals given; this was first abated in the following manner: A small magnet was placed in each signal box, the armature of which when released operated to short circuit the break wheel, thus preventing the circuit from opening in the box. The above armature was further provided with a knife edge engaging a similar knife edge on the dentin, so that if the circuit was open when the box was pulled the armature would be forced against the short-circuiting contacts, and keeping it there while the box was in operation. On the other hand, should the circuit be closed when the box was pulled the opposite sides of the knife edge would engage, thereby forcing the armature against the magnet and keeping it there while the box was in operation. The weak point in this arrangment was that should a box be pulled just at the time the break wheel in any other box in its revolution engaged the contacts, interference would occur. This defect has been remedied in the more modern boxes so that should the armature of the non-interfering magnet be released at the time the door is opened for pulling in an alarm, or any time between opening the door and pulling the hook, the dentin cannot be engaged and the box remainsinoperative. This system ,whilea great improvement over those previously mentioned, was not perfect, in that a person pulling a box and getting no response would probably wait a short time and try again; but if he neglected to close the outside door the box would still remain inoperative though the circuit might be clear.

The latest improved boxes have the succession non-interfering principle. In this box the mechanism is so constructed that when a box is pulled after another has been started it will retain its signal until after the first box has finished, and will then transmit its signal without any possibility of interference or confusion.

On account of the common use of heavy currents for power and electric lighting, it has become necessary to provide each signal box with a cut-out that in some boxes operates to cut the entire box out of circuit when the door is closed. This not only serves to protect the box, but also greatly reduces the resistance of the system, thereby saving battery power. This cut-out is also arranged so that the box can be tested electrically and mechanically without disturbing the circuit. Lightning arresters are fitted to all boxes, strikers and gongs as a protection against disruptive discharges. The boxes are also provided with trap locks, so that when the box is unlocked the key cannot be removed except by a release key, these keys being carried by officials only.

The importance of transmitting alarms with the least possible delay has led to the introduction of various schemes for saving time in pulling in a box. In some cases a small auxiliary box with a glass front containing the key is fastened to the door of the

signal box ; in order to get the key the glass must be broken. Another method is to have the hook or trigger protrude through the outer door, the end of it being encased in a small box as previously described. In this arrangement no key is required, but simply break the glass and pull the hook. Another arrangement, and probably the most popular one, consists of a trigger in the form of a handle attached to the door of the box, which being moved a half turn winds up clock work attached to the inside of the door, and this in turn operates to pull the trigger in the inside box, at the same time ringing a gong, indicating that the box is operating. The last named arrangement is the most convenient, but is open to the objection that false alarms can be pulled in boxes located in out-of-the-way places without much fear of detection ; in fact, a box of this style has been removed from one of our principal streets to the police station for safekeeping ; nevertheless, this style of box is used exclusively in many cities and very little trouble is experienced with them.

Great improvements have been made in gongs and tower strikers, but time will not admit of a detailed description of them; but a very valuable feature has in recent years been added to the signalling system that is worthy of notice, viz., the visual indicator. This instrument not only strikes the number of the box, but in addition indicates it in plain figures, thus removing all doubt or occasion for difference of opinion as to what box was pulled.

The central station, a very important part of the system, has also been greatly improved in recent years. At the inception and for many succeeding years, the gravity battery held full sway as the source of electrical energy ; but since the introduction and common use of the dynamo and the perfecting of the secondary battery, the old reliable gravity battery has become to a large extent a back number, and wisely so, for it is at best a very expensive system and requires considerable attention, while with the secondary battery, though the first cost is greater, the saving is so great that there is no room for comparison—in fact, the cost for charging batteries is so small that in many places it is furnished free by the local companies. In large cities current is used from the commercial circuits after being transformed to the required pressure.

REPEATER.

Another very important part of the central station is the automatic signal repeater. In a fire alarm system the circuits are run to all sections of the city, and if they were all connected together in series the combined grounds on them all in bad weather would make it very uncomfortable for the superintendent. The office of the repeater is, as its name indicates, to automatically repeat any signal coming in over one circuit, on all the other circuits in the system. This is a very fine-working instrument and probably deserves the praise bestowed on it by Sir William Thompson, now Lord Kelvin, at the Centennial Exposition, when he said it was the most ingenious and finest piece of telegraphic mechanism ever exhibited. It not only repeats the signal instantly, but in case a circuit breaks the repeater, after sounding one blow on the other circuits, throws the disabled one out of service, leaving the others intact. As soon as the broken circuit is repaired it is automatically taken into service again. In a large city where the circuits amount to more than ten in number, a manual central office is necessary. In such an office operators are constantly on duty to receive alarms from the box circuits and to send them out over the alarm circuits, also to watch and test the circuits by means of a far more complicated and expensive apparatus than is necessary to use in smaller localities. In a system embodying a manual central office, the instant that a street box is pulled the following notifications are simultaneously approving where the skilful operators are on watch for them. The box number is being sounded on a tapping or small gong, the same number is being recorded visibly by the multiple pen-register, and a cylinder, which is one of a series representing every circuit in the system, revolves and brings into view on its reverse side the numbers of the boxes on the circuit from which the alarm has come. Upon the completion ot the first round of any of these signals the operator, by a single movement of a lever on the switchboard, connects the box circuits with the combination alarm circuits and instantly the box number is being tapped in the engine houses and recorded on the tape register direcly from the street box. The next operation is to set the dial transmitter to the number of the box required, which send out over the alarm circuits as many rounds of the box number as the rules may require. All alarms are, therefore, received simultaneously at the engine houses over two district circuits and registered and announced on two sets of instruments.

All of this is, of course, done within less time than it takes to read this description of the process, and usually before the alarm box stops running, after it has been pulled for an alarm, the signal has been received at the central office, has been sent out over two independent circuits, the firemen have responded, horses have been harnessed, and the apparatus on its way to the fire.

Other important parts of the equipment of a large central office are the pin register, line tester and annunciator board. The first of these automatically registers upon a paper roll the record of all the signals received into or transmitted from the office. The line tester automatically tests all the circuits and every twenty minutes reports any grounds or open circuits that may occur. The annunciator board is for the purpose of showing the numbers of the companies which have left their houses to attend alarms, and as fast as these companies are released from duty the operator restores the corresponding drop. Thus, at a glance, the operators can tell at all times what apparatus is available. The line construction of a fire alarm system should be of the best description. A line down or rendered inoperative by crosses or grounds might cost many thousands of dollars more than the first cost of the whole system. The writer is of the opinion that when fire alarm wires are on poles used for carrying other wires they should be on top of all others and as far as possible removed from them. This is by no means the universal custom, however, as many prefer to have them strung on the lower arms.

It is scarcely necessary to add that a fire alarm system requires constant care and attention—the nature of the service and the grade of apparatus employed will suggest this. The agent will probably tell you confidentially that any fireman can keep it in order, likewise the dynamo agent—and we have a few, though not enough, in our Association—who will tell you that the particular generator that he is selling is absolutely self-oiling, self-regulating and self-righteous ; but it does not always follow that this is so, as some of us can testify to.

I have tried briefly in this paper to give the evolution of the fire alarm telegraph, and if in so doing I have succeeded in showing its importance in connection with any fire department regardless of size, I shall feel amply repaid for the time spent in writing it. Surely the recent disastrous fires in some of the fairest of Nova Scotia's towns are object lessons not to be put lightly aside.

DISCUSSION.

Mr. Hamilton, after expressing his pleasure at listening to so valuable and interesting a paper, questioned Mr. Colpitt regarding the use of storage batteries in operating the system, in lieu of primary batteries, also regarding the satisfactory results of charging storage batteries from alternating current circuits through the medium of the rotary transformer.

Mr. Colpitt, replying, stated that secondary batteries had almost superseded primary batteries in the larger cities, and that rotary transformers had been used successfully in charging same. He stated that it required but little energy to operate the fire alarm system, the current rarely exceeding one-tenth of an ampere at a potential, depending upon the length and number of circuits.

Mr. Bowman followed, and after congratulating Mr. Colpitt on the concise manner in which he had presented so interesting a subject, expressed the opinion that it would prove of great benefit to laymen in general if the paper could be distributed among them. It would have a tendency to make town authorities purchase reliable apparatus.

Mr. Chambers interrogated Mr. Colpitt more closely regarding the charging of accumulators from street mains, and concluded his remarks by moving that a vote of thanks be tendered Mr. Colpitt for his paper.

The President then introduced Mr. Hamilton, who presented the following paper entitled "Reminiscences."

REMINISCENCES.

By F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E.

The telephone, like many other adaptations arising from discoveries of nature's secrets, is the outcome of evolution, but it is a plant which, when once matured soon burst into blossom and bore fruit. The marvellous instrument is in more general use

than any other signalling apparatus under the sun, and yet it is the one concerning which those who use it the most are the very people who know the least about it. I, of course, allude to the general public.

It is simply astonishing to what an extent familiarity breeds indifference—particularly as regards some of the most prominent apparatus of applied science. The locomotive is an old tried and trusty contributor to our comforts and necessities, but how many of the thousands of people who are now being rapidly transported by this picturesque and snorting iron horse have the remotest idea as to its internal structure, or of the manner in which the steam power is applied?

Reverting to the telephone, it may not be an inappropriate observation to say that this most delicate and sensitive instrument is subject to more indignities than any other public servant one can call to mind at the present moment. The telegraph has doubtless occasionally conveyed sulphurous odors sufficiently strong to be a source of discomfort at remote distances, but the telephone leaves it far behind in respect to the conveying of "cursory" remarks and vituperative utterances. Never was an innocent victim more sinned against in this respect than the gentle telephone.

It would be interesting to study the nomenclature which has been introduced since the advent of the telephone, but this is neither the time nor the place for such enquiry; I would merely remark that "telephone beef" is a significant term as applied to meat ordered through the medium, instead of being selected by the housekeeper, and that "aught" instead of "naught" is a less justifiable innovation which by a strange perversity is in general use among telephone operators, especially in the United States.

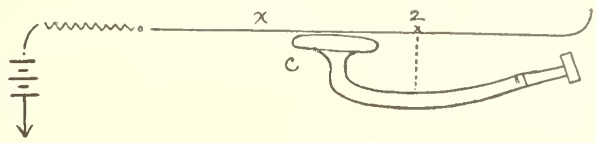
It was my habit at one time to regard the submarine telegraph cable as analagous to the steamship line, the land lines to the great trunk lines of railway, and the telephone lines as the interurban and suburban roads, but there is more than a doubt in my mind as to whether the analogy holds good at the present day, for the telephone is now carrying a considerable portion of the heavy traffic.

Speaking of the strong language to which the introduction of the telephone has given rise, or rather has been the means of radiating, one is naturally led to reflect that the age in which we live is an extremely exacting one. When we contrast the condition of things as they existed say, fifty, forty, thirty, nay twenty years ago, and even nearer to the present time as far as some places are concerned, when we compare the means of transportation, the methods of lighting, the facilities for communication, not only between cities and provinces, but between countries and continents, we cannot but recognize the centuries of difference between the crude methods of the past and those of to-day, and yet there are those who in their early days read by the flickering flame of the farthing rushlight or the tallow candle, and who travelled at a snail's pace in a springless cart, whose knowledge of the world outside of the prescribed limits of their own village was extremely meagre—owing to the sluggish means of inter-communication—who would have laughed to scorn the idea of electric telegraphs, and declared that the semaphore was sufficient for all such needs; who would have pronounced a man mad had he claimed to be able to speak viva voce along a wire, and derided as a fool the dreamer who ventured to predict that the ordinary horse-drawn carriage would be succeeded by such a conveyance as that described by the Celestial as "no pushee, no pullee, all samee hellee," which now rushes clanging through our streets.

But let there be an instant's delay in connection with the telephone, or the street car, or an interruption in telegraphic communication, or even a flicker in the electric light, let such things happen, why then the air becomes of an unnatural tint and perturbation reigns supreme. Verily, this an exacting age. I am not complaining, but simply stating what I believe to be a fact.

I am not sufficiently conversant with the details of the telephone business as it exists to-day to discuss the manifold appliances connected therewith, but with regard to some of the multifarious uses to which this instrument can be applied, I can speak from experience. As an aid in the detection and localization of faults in subterranean and sub-aqueous electric cables, and in electric circuits generally, the telephone can be used with great advantage, as the following instances will sufficiently illustrate:

Let A ——x——2—— B be an insulated conductor in which a leak exists at 2, the approximate position of which has, in the case of a subterranean cable, for example, been determined. By applying an intermittent current to the line and using a coil of insulated wire in circuit with the telephone, the exact position of the fault can be found without cutting the cable. With the end free at station B, and an intermittent current applied at A, the length x + 2 becomes the primary circuit, and the coil c with the telephone the secondary circuit. By moving the coil along the line and applying the ear to the telephone the position of the fault can be determined with the greatest accuracy, for immediately on passing 2 the inductive effects will be reduced and



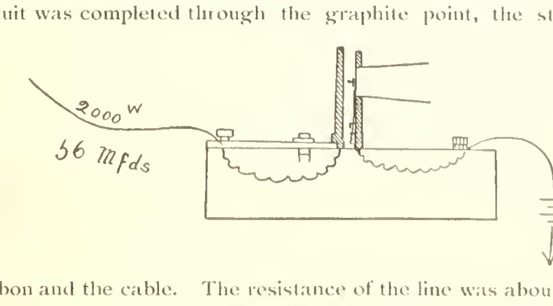
the vibrations of the diaphragm of the telephone correspondingly enfeebled.

In repairing the street cables here in Halifax some years ago for the Direct United States Cable Co., the application of this method enabled me to save no inconsiderable expense, the labor in opening up the trench in which the four cables were laid being in consequence but a small item.

I have also found the telephone useful in detecting the exact moment when a change occurs at the "fault" consequent on the reversal of the battery current. According to the amount of conductor exposed at the break, or leak, will depend the length of time between the application of the current and the evolution of hydrogen gas at the fault, after the positive pole of the battery has had the effect of depositing chloride of copper on the exposed surface of the conductor. The telephone, being connected through a condenser on the line end of the Wheatstone bridge, will enable the operator to immediately detect the moment when the change of condition takes place.

Another very interesting and extremely useful application of the telephone in submarine cable repairs, after a splice has been made, is to ascertain if the line is working. It has sometimes happened that in making what is known as a "final splice" to a cable at sea—that is to say, joining up the two ends which connect with the shore on either hand—that a rupture has occurred, unknown to those on board the vessel. By means of a prearranged system of signals from each station, and the application of the telephoue in the manner already described, the rupture of the cable would be known on board by the absence of the signal from the station cut-off.

It would be interesting to know what is the greatest length of submarine or subterranean cable through which telephone speech has been exchanged. As long ago as the year 1878, when the construction of various forms of microphones was one of my hobbies, I tried an experiment, the mention of which may perhaps be of interest. It was during the repair of a cable between Sydney, C.B., and the Island of St. Pierre-Miquelon. We were about 20 miles from Sydney. I requested St. Pierre to put on a telephone. The reply was, "It is no use; we tried to speak to Placentia, but did not succeed." The length of cable between St. Pierre and Placentia being 112 nautical miles, and that through which we were signalling 188 miles, including 20 miles on board the ship, rendered the conditions anything but promising. However, I persisted, and St. Pierre joined up his telephone. The transmitter—or, as I then called it, the microphone—I had in circuit was fearfully and wonderfully made. The base was a cigar box, on which were mounted a piece of battery carbon, a frame carrying a parchment diaphragm, against which a spring with a pencil point graphite lightly pressed, and a mouthpiece. The circuit was completed through the graphite point, the stick of



carbon and the cable. The resistance of the line was about 2,000 ohms, and its electrostatic capacity about 56 microfarads. Into the mouthpiece of the microphone I sang a snatch from a light opera then popular, scarcely daring to hope that the sounds would be heard at St. Pierre, but on joining up to the Morse instrument and enquiring if they had heard anything, ? the reply was "Yes, heard someone singing."

What tune? We asked.

"Fille de Madame Angot" was the correct answer.

An encore being called for, several other tunes were warbled into the monster. But we did not succeed in imparting audible articulations.

There is another application of the telephone to which I may here allude. In April, 1885, whilst crossing the Atlantic after a heavy gale, we came upon a dismasted vessel, the barque "Hudson." This vessel, bound from Java to London, 131 days out, was a pitiful, but withal picturesque object. Jib-boom, foretop mast, main-mast, all gone, the foreyard and fore-topsail yards hanging a-peak, bulwarks washed away, and a labyrinth of rigging snaking alongside. On the stump of her mizzenmast was lashed a stun-sail boom, rigged for a signal staff, and on it floated jauntily the gay bunting "KRL" of the Commercial Code, signifying "will you take me in tow?"

We did take her in tow, and along one of the hawsers I had a length of insulated conductor secured, by means of which telephonic communication was established between the two vessels.

Whether towing vessels are now provided with such means I know not, but there is no reason why frantic gestures, fearful yellings and demoniacal howls should be the sole means of conveying "intelligence" between the towing vessel and the towed.

I trust that you will excuse me for indulging in these reminiscences; such recollections are apt to crowd upon one in reviewing events in connection with such operations as those to which allusion has been made. I began my remarks with the intention of eulogising the telephone, and it may not be too much for me to say that I have made out a fairly good case in favor of this much used, much abused and withal unique application of scientific discovery.

There is one point of interest to be mentioned, but the discussion of it does not come within the scope of this paper. I allude to the manner in which telephone wires are run within buildings. When one considers the multiplicity of elaborate rules issued from various sources relating to the installation of electric light and power circuits, one marvels at the absence of any adequate provision against the ingress of foreign currents into a building via the telephone wires. I could point to an instance in this city of a narrow escape from a serious fire, resulting from an outside contact between the telephone wire and a conductor carrying a heavy current. The fact is, all wiring should be run in conduits wherever practicable. Of course it would be impolitic to condemn all the old wiring, but all new buildings should be provided with conduits. I beg to thank you for your kind and patient attention.

DISCUSSION.

Mr. Anderson opened the discussion by commenting upon the valuable suggestions embodied in the paper, and in referring to the careless method usually adopted of running telephone wires, expressed the opinion that more stringent rules should be adopted by the National Board of Fire Underwriters in regard to the installation of telephones, etc.

Mr. Chambers cited an instance of serious damage resulting from fire caused by the telephone wire coming in contact with live circuits outside of building. Had the same care been exercised in installing the telephone wires that is taken when installing electric light wires, the trouble would not have occurred.

A vote of thanks was tendered Mr. Hamilton for his valuable paper.

The President then introduced Mr. J. A. Anderson, who read a paper on iron-armored conduit installations.

THE IRON ARMOURED CONDUIT INSTALLATION AT ST. MARY'S CATHEDRAL, HALIFAX.

By J. A. Anderson.

The first iron or steel conduit system in Halifax was installed some 16 months ago by Messrs. John Starr, Son & Co., in St. Mary's Cathedral, under plans and specifications drawn up by Mr. F. A. Hamilton. The conduit used is uninsulated mild drawn steel, made by the Boston Electroduct Co., and is coated with a special compound which prevents oxidation or rusting of the surface. The makers claim that coated samples of this conduit have been immersed in acids and alkalies and buried in the ground for over a year, and has also been soaked in sea water and subjected to steam and oil, and in every case the coating remained intact and the lustre as bright as when first applied.

The wire used is double rubber covered and double braided. The several circuits are controlled from a slate switchboard which is located in the vestry of the church, in a large cabinet handsomely finished and having plate glass doors, giving full view to the whole interior; on this board is mounted one 50 ampere and eight 35 ampere switches of the knife pattern, also one pilot lamp and bracket and the Tramway Co's watt meter. The main and branch circuits are separately protected with fuses of the Link type connected to brass terminal screws which pass through the board and having brass lugs attached thereto, the wiring all being done on the back of the board, the wires being "sweated" into the lugs from where the pipes pass through the floor into the basement of the church, passing through the necessary junction boxes, some of which are located at the base of the large columns, on which are mounted the different fixtures in the body of the church. Smaller pipes are used from the junction boxes to the outlet and placed in the recesses of the column, and are marbleized to match the church finish. The piping was all completed first, then the wires were drawn in by means of a No. 10 galvanized wire.

The circuits are laid out so that there will be no unnecessary waste of light, and at the same time that sufficient light may be had for the different devotions, and are divided as follows: (1) two centre columns and east porch; (2) east altar and pulpit; (3) west altar and sanctuary; (4) west columns; (5) east columns; (6) organ, under gallery and porch. The brackets and fixtures were made from special drawings prepared by the Rev. Dr. Murphy; they are combination gas and electric and are finished in rich gilt. The advantage of having lights properly switched has been exemplified in this instance in effecting a saving in cost with the use of electricity with a 50% greater number of lights than there was originally with gas.

DISCUSSION.

Mr. Hamilton opened the discussion. He questioned the apparently needless statement found in the rules of the Fire Underwriters Association, i.e., that wires used in iron-armored conduit work should be provided with a double braided cotton covering. He considered that the one essential of wire used in this method was that it should be flexible. The double braiding was not necessary as far as insulating qualities were concerned, and certainly did not add to the flexibility of the wire.

Mr. Huntress, while partly endorsing the views of Mr. Hamilton, expressed the opinion that the better insulated the wire was, without reducing its flexibility materially, the less danger there would be from careless wiremen, who neglected to form a bell mouth at the ends of the conduit, which reduces the danger of abrasion to a minimum.

Mr. Hamilton supported his previous contention by stating that the wire would be made needlessly large by adding the double braiding, and thus require larger sizes of conduit. He also raised the question why flexible cable was not used to a larger extent than it is for this class of work.

Mr. Siebert stated that the reason for such a rule was to protect the customer from poor work.

Mr. Bowman said the rules were a combination of all interests, being compiled by representatives of all those concerned.

Mr. Anderson cited some cases where weatherproof wire had been used for circuits, and a short piece of rubber-covered wire soldered on where the wires emerged from the conduit, in this way taking advantage of the customer.

Mr. MacKeen referred to a case which occurred in Boston in connection with pulling in wires through conduit. Considerable difficulty had occurred in pulling the wire through a long conduit owing to the crushed condition of the pipe, caused while forming offsets.

The passage had been so reduced that considerable force was necessary to pull the wire through, so much, in fact, that the wire stretched to such an extent that the diameter was materially reduced, thus reducing its carrying capacity, and consequently it had to be withdrawn

Mr. Siebert expressed the opinion that more stringent rules should be adopted by those qualified to compile them, and steps taken to enforce them, thus overcoming the rascality of some wiremen.

Mr. Anderson thought that if wiremen were required to qualify before being allowed to practice the profession, less trouble would result from careless workmen.

Mr. Archibald, while partially endorsing the views of Mr. Siebert, thought that a limit was neccssary. If too stringent rules were adopted and enforced, there would be a great temptation on the part of wiremen to violate them. In concluding his remarks, he moved a vote of thanks to Mr. Anderson for his valuable paper.

The following paper on "Steam Engineering," by Mr. P. A. Freeman, was read by the Secretary :

STEAM ENGINEERING.

By P. A. Freeman.

The subject of this paper, Steam Engineering, covers such a broad field that I finally decided to confine my paper to certain limits, avoiding all intricate formula and deductions, although both are necessary for the competent engineer.

At times it is somewhat difficult for an engineer to decide upon the type of boiler to use, and in every case the choice should depend upon the nature of the work demanded, whether it is better to use water tube, externally or internally fired, etc. Many plants are able to use with good economy a return tubular boiler, and the selection of a water tube boiler would be of no advantage in comparison with the increased first cost.

For railroad work and for any kind where the demand for steam is liable to increase rapidly during certain hours of the day, the water tube boiler is by far the best. With a first-class water tube boiler a fireman can carry for a certain length of time from 50% to 100% above the rating of the boiler.

In our plant at the tramway station we have four 250 h.p. Babcock & Wilcox boilers, and it has been a common occurrence during the winter months for us to carry 50 to 75% above the rating of the boilers for several hours. For such service a quick steaming boiler is necessary, and is only to be found in the water tube boiler.

In these days of keen competition it is absolutely necessary to take every precaution for reducing operating expenses, of which the coal pile represents a large percentage. The best of boilers will not take care of themselves and will generate steam according to the manner in which they are treated. Shovelling coal into the furnace and keeping a sufficient supply of water in a boiler do not constitute the entire duties of a fireman. He must shovel coal and feed water to the boiler intelligently and study the peculiarities of the steaming properties of his boilers and coal. I might add that no two boilers of the same make with exactly the same handling will give the same results.

The proper maintenance of boilers demands that they should be shut down and examined inside and outside thoroughly at least every nine weeks. The boiler should be thoroughly blown out and cleaned even if solvents are to be used for the prevention of scale. In our plant we use the following method for preventing scale and for cleaning boilers : The feed water is supplied to the boiler from a tank capable of holding 3500 cubic feet ; suspended in this tank is a bag containing about 50 lbs. of lime, which is renewed twice each month. We find that this method of treating our feed water has a considerable tendency to prevent scale formation. When the boiler is taken off the line for cleaning and general overhauling we pump it full of water, in which about 10 lbs. of sal soda have been dissolved while it is still under full pressure. It is then allowed to remain 48 hours, when by this time the steam pressure has fallen. The blow-off is opened and the boiler emptied. It would seem at first that this would be sufficient to thoroughly cleanse the boiler, but it is not so. If the feed valve is slightly opened and the water allowed to flow slowly through the boiler it will then be thoroughly cleaned, as this slow filtration through the boiler seems to bring with it all the dirt, scale, etc., which was not carried away by blowing down. Also, particular care should be taken that the feed valves of the other boilers are closed during the time we are filling the boiler with the sal soda solution, otherwise the brass fittings, etc., will be seriously affected.

Safety valves are the most delicate part of a boiler and demand constant care and watching if we wish them to work fairly accurately. My experience with spring safety valves has led me to adopt the rule that all our safety valves shall be lifted from off their seats once every 24 hours. If this is not done I find that a so-called skin forms on spring and seat, and if the valve is not lifted oftener than once a week it will take considerable more pressure to lift it than for which it was originally set. Another very serious trouble with safety valves which often occurs is the loosening of the check nut, and if this is not attended to immediately upon the indication of such trouble the steam pressure will drop and all steam escape into atmosphere, shutting down the plant. Although it at first appears difficult to the engineer or fireman to tighten the nut and set the valve properly, nevertheless if he understands his type of valve thoroughly he can accomplish it with his monkey wrench, hammer and chisel in verv short space of time with perfect safety to himself and plant. If the valve should commence to blow off and steam pressure drop more than 5 lbs., or if the steam pressure should at any time drop more than proper on account of the safety valve blowing off, the engineer or fireman should at once assume that the valve is out of order and must be attended to immediately. If check nut is loose it can be remedied by turning the valve spindle to the right until the steam stops escaping, then the cap may be removed and the check nut tightened without further difficulty. The boiler pressure should be increased to the same point at which the valve blew off, and beyond, in order to make certain that the valve will blow off at the proper pressure. This point can be easily obtained by slightly turning the valve in the proper direction.

The above method of handling the safety valve is that commonly used in ordinary practice, but for close regulation the cushion seat should also be raised or lowered according to the range within which it is desired to have the safety valve act. Under no conditions should the safety valve spindle, or any of its parts be struck or hammered in order to make it close, as this is a very dangerous practice and is liable to cause more or less serious explosions. This latter precaution of mine may seem to be hardly necessary, yet in my own experience I have seen an engineer strike down on the spindle with a piece of wood 6 x 6 with the idea of causing the valve to close. Although at this time of which I speak no serious results occurred, it might cause great danger the very next time it was tried.

Water tube boilers have the following very essential qualifications not met with in other types of boilers :

They have the property of steaming quickly on account of the rapid circulation and good combustion. The liability of dangerous explosions is reduced to a minimum on account of the tubes, which are the weakest point of the boilers, splitting and thus allowing extra vent for the steam. On the other hand, these tubes are easily and quickly replaced if burned out or injured in any manner. For fear some of you might obtain the impression that the tubes are a weak point in the ordinary running, I might state the case of one set of boilers which we have in our station. These boilers have been in constant use for seven years, and the only repair necessary beyond that of replacing grates and brick was the inserting of one tube which had been injured through carelessness in allowing water to flow over the outside of the tube from a leak in the feed water piping. This caused a blister on the tube, and although it did not weaken it seriously, it was considered advisable to replace it before any damage should occur.

My experience has led me to believe that boiler explosions are caused by careless and unintelligent attention to the supply of water, and not at all times through any inherent defects in the boiler. The gauge cocks should be tried regularly in order to detect any false indications of water in the glass. False indication of water is not by any means an uncommon occurrence. The sudden breaking of a gauge glass causes the valves of the column to be closed, and on replacing the glass the bottom valve is opened and the upper one forgotten. The glass under such conditions will show false water, as the water will remain in the glass until the boiler is emptied, held in position by the vacuum in the top of the glass. This very case has occurred in our own plant, but any dangerous results were averted by prompt action.

In connection with this I recall an answer given by my chief in the west end power house to the Board of Examiners. He was asked what he would do if on entering a boiler room he discovered

(Continued on Page 86.)

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Correspondence is invited upon all topics legitimately coming within the scope of this journal.

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Acetylene Gas.

THE Boston Manufacturers' Mutual Fire Insurance Company, in response to many inquiries from its members, has had the subject of acetylene lighting, including its advantages and dangers, and the proper appliances to use for the purpose, carefully examined, and, as a result of its examination, advises its members not to try the experiment of using it at present, until better methods and appliances are available than any yet put on the market.

Inspection of Steam Boilers.

THE government of British Columbia has passed a law providing for the compulsory inspection of steam boilers before being put in operation, and periodically while in use. It is learned that the government of Nova Scotia will, at the next session, introduce a bill along the same lines. The day is apparently near at hand when all steam plants in the Dominion will not only be placed under the supervision of government inspectors, but when additional protection will be afforded the public by making it compulsory upon engineers to show that they are properly qualified to assume charge of a steam plant. Surely Ontario, the banner province of the Dominion, will now follow the example set by British Columbia, and thus assist in raising the standard of steam engineering in Canada. Unfortunately, one or two attempts in the past to secure a law for the licensing of engineers have not met with success.

The Maritime Electrical Association.

IN the building up of an association, much depends upon the character of the foundation established in the early days of its existence. Conscious of this fact, the promoters of the Maritime Electrical Association, formed one year ago, have labored earnestly to reach that point from which there would be likely to grow a useful and progressive association. How far they have succeeded can be judged in a measure from the report of the second convention, which appears elsewhere in this number. Notwithstanding drawbacks, which need not here be enumerated, the standard reached within the short space of twelve months since organization should be encouraging to the executive officers and those

members who have contributed to its support. If the present interest can be maintained, there need be little fear of the future welfare of the association. Its membership is now over sixty, and it is believed that this can be considerably increased, particularly by interesting a greater number of cable and telegraph men. The several excellent papers and the discussions thereupon, which formed one of the most important features of the recent convention, is a most hopeful indication of a successful association. It is encouraging to observe the practical character of the papers and their wide scope, being designed to interest the lighting, railway, telegraph, telephone and fire alarm departments of the electrical industry. To the author of each paper equal credit is due, but the subject of electric meters, taken up by Mr. Mackeen, is one which has a particularly wide interest. While much has been written regarding the meter, we seldom find the subject treated in such a practical and simple manner as in this paper. As a means of inducing discussion upon questions brought out, it would be an advantage to have copies of the papers placed in the hands of the members prior to the day of the convention. They would then be able to read them carefully and discuss them more intelligently at the meeting. This as a suggestion to the officers-elect, who will be equally interested with their predecessors in strengthening the association.

The Electric Light Bill and the Canadian Electrical Association. THE passing of the Conmee Bill should be, and doubtless is, the subject of congratulation and thankfulness on the part of private electric lighting companies in Ontario. It gives a fair measure of security to their investments, which could at any time previously have been wiped out by the decision of the municipality to engage in electric lighting. The clause which provides that the price to be charged by the company for light shall be determined by arbitration in the event of dispute, is of distinct advantage to the municipality, and must tend to lessen the desire for municipal control. Notwithstanding the manifest wish and attempt of the promoters to make the provisions of the Bill fair both to the companies and the municipalities, its course through the Legislature was attended by many uncertainties and difficulties, of which those not intimately associated with the movement can have little appreciation. Well known members of the House who were depended on to take charge of the measure, after expressing their willingness to do so, afterwards declined, thereby causing delay and anxiety. Finally, however, the task was accepted by Mr. Conmee, and the result showed that it could not have fallen to better hands. The strongest possible opposition was offered to the measure by certain newspapers who saw an opportunity to make a bid for public favor, and of following the example of the Irishman of whom the story is told that he always made a point of voting with the majority. The statements of these papers were rightly discounted by the members of good judgment in the House, to whom it must have been apparent that the time had arrived when some consideration should be given, not only to the rights of the masses of the people, but of those who had freely invested their capital for the development of an important industry, from which large convenience and benefit had accrued to the public. The policy of the companies should now be "What we have we'll hold." The rights secured by the Conmee Bill must be carefully guarded. Assaults may and probably will be made on the new legislation at future sessions. Steps should therefore be taken whereby an organized effort can at any time be made to resist the passing of amendments calculated to weaken or destroy the protection afforded by the Bill. The usefulness and value of the Canadian Electrical Association have been clearly demonstrated in connection with this movement, which has ended so satisfactorily, and which was conducted through the medium of that organization. Without such an organization the work could not have been so expeditiously and effectively done, and the result might not have been so satisfactory. Credit is also due to the following gentlemen composing the Legislation Committee, who, in conjunction with the President and Secretary of the Association, and the solicitors, Messrs. Donald Guthrie, Q.C., and W. D. McPherson, successfully conducted the campaign: John Yule, manager of the Guelph Light & Power Company, Guelph, chairman; W. H. Comstock, president of the Gas & Electric Light Company, Brockville; B. F. Reesor, manager of the Light, Heat & Power Company, Lindsay; J. J. Wright, manager of the Toronto Electric Light Company, Toronto; C. B. Hunt, manager of the London Electric Co., London; A. L. Breithaupt, manager of the Berlin Electric Light & Street Railway Company, Berlin; R. O. McCulloch, of the Goldie & McCulloch Company, Galt; David Speirs, president of the Electric Light Company, Galt; John Farley, Q.C., president of the Gas & Electric Light Company, St. Thomas; S. J. Parker, president of the Electric Light & Gas Company, Owen Sound; Thomas Sadler, president of the Light, Heat & Power Company, Lindsay. Many of the companies by their co-operation gave valuable assistance to the committee. These companies, and all others, should now become members of the Canadian Electrical Association, and give what support they can to an organization that has already done much and may in the future do more for the development and welfare of the electrical industry of Canada. We hope to see at the annual convention of the Association at Hamilton in June a larger representation than ever before from the electric lighting companies.

THE CANADIAN ELECTRICAL ASSOCIATION.

At a meeting held recently of the Committee appointed to make the local arrangements for the approaching annual convention of the Canadian Electrical Association at Hamilton, a draft programme was considered and adopted. The dates selected for the convention, subject to the approval of the Executive, are the 28th, 29th, and 30th of June. The business sessions, as well as the annual banquet, will probably be held in the new Royal Hotel. A sufficient number of papers on a variety of subjects of interest to those engaged in the various departments of electrical work, have been promised, and are in course of preparation. Among the features of entertainment will probably be a trip to the Beach over the Hamilton Radial Railway and an evening excursion on the lake, a trip to Grimsby Park over the Hamilton, Grimsby & Beamsville Electric Railway, and a visit of inspection to the stations of the Cataract Power Company at St. Catharines and Hamilton. The Hamilton Street Railway Company have very kindly offered free transportation to members of the Association during the convention. Everything points to a successful and enjoyable meeting.

MARITIME ELECTRICAL ASSOCIATION.

(Continued from page 83.)

no indication water in his boiler. He said he would make sure his water was shut off, close all drafts and open his fire-box door. On being asked what he would do next, he replied that he would leave the building and watch it from a safe distance.

Pumps are usually given the least care, worked the hardest of the equipment, and at the same time play the most important part in a station. They should be given the same careful attention as the steam engine. We make it a practice to completely overhaul our pumps once a week in order to detect any faults that may exist, or are liable to occur. Special care should be paid to the water plunger and valves; valves should be used which are made to withstand the temperature of the water which passes through them. Disregard to this may cause serious trouble.

All modern plants should be equipped with heaters and condensers, either jet or surface. In our station the heaters raise the temperature of the feed water during the winter months to 120° and during the summer months to 140°. This difference in temperature is accounted for by the difference in temperature of the city water at the above seasons. We use a jet condenser, which gives an increased economy of 20%. Surface condensers should not be used if possible on account of the deteriorating effect of the oil upon the tubes of the boilers, and if the water is not to be used again in the boilers, then there is no gain, but a loss, in installing surface condensers on account of increased first cost and increased cost in running. Heaters and condensers demand the same careful attention as pumps.

The selection of an engine demands the same careful consideration as boilers, whether high or low pressure, single or compound, high or low speed, steam jacketed, etc. For heavy and variable loads the compound engine is generally accepted. Large low speed compound engines with wide expansion are generally accepted as more efficient than the single cylinder engine. This is clearly shown by the result of test on the compound engine in the U. S. gunboat "Boche." When this engine was run as a single engine it used 24 lbs. of steam per 1 h.p., and when run as a compound engine with the same load, steam pressure, and under the same general conditions, it only used 20 lbs. of steam per h.p., thus demonstrating that the compound engine was 20% more efficient than the single engine. Especially are compound engines more efficient with high steam pressure.

Engines for street railroad work, and other work imposing sudden changes of load and unusually heavy strains, should be built with heavy forged cranks, and wheels of about double the usual weight, and with all the parts in such proportions as will give perfect work under the most trying conditions. Governors for this work must be especially good and must respond to sudden changes of load and continue to regulate closely under all circumstances. The variable cut-off on low pressure cylinders is also a strong point in such engines for this work, as it ensures quick work, quick regulation and high economy. Under variable loads the regulation of our Robb engine is within 2%, giving the greatest satisfaction, and up to the present time two of this type of engine have been in constant use on our railroad load since February, 1896, on an average of 18 hours per day, from no load to full load and at times 50% overload. We set our values for our average load, as the maximum pull does not last longer than 10 seconds duration.

An engine should be indicated every three months, on account of the wear and tear of the parts and variation in the valve rod. Our engines were first set by hand and then by the use of the indicator, and a saving of 19% was shown. On taking charge of our present plant the boilers were carrying nearly their capacity. By indicating the engines and setting valves properly we were able to increase our engine load 50% and only increased our boiler load 10%.

All this simply goes to show that the indicator should be used freely and intelligently in order to effect the greatest economy.

The profitable use of steam jackets is a much discussed question, and many engineers disagree. My experience with 9-100 h.p. steam jacketed engine has led me to doubt the advisability of using the steam jacket. In my opinion the extra cost of maintaining the extra steam piping and traps, and the liability of damage to the cylinders, more than counterbalances the saving obtained by steam jackets. If an engine has cooled down the greatest care must be taken in re-heating the cylinder through the use of the steam jacket, or else a cracked cylinder will result on account of the unequal expansion. Such an accident has occurred under my own observation, and it has not made me very enthusiastic over steam jackets.

If I did not consider that I have already occupied my share of your time I would like to take up the subject of engineering in a more technical manner, giving figures to back up my statements; also the proper handling of coal, draft, etc., but the latter subjects demand a paper on themselves and can hardly be treated sufficiently in a paper of this kind.

I wish to thank the members for their attention, and if the paper has suggested any questions which might be asked, I shall be only too glad to try to answer them.

The conclusion of the reading of the paper was greeted with applause, the subject proving an exceedingly interesting one.

DISCUSSION.

Mr. MacKeen, in opening the discussion, referred to the use of lime as a solvent in neutralizing the effect of acids present in the city water, also stating that some information regarding the different solvents used for this purpose might be of general interest.

The President, Mr. Bowman, referring to the use of a tank, asked Mr. Freeman if the tank was of sufficient size to permit matter in suspension in the water to settle. He also referred to the unreliability of gauge glasses, expressing the opinion that gauge or try cocks were more reliable and satisfactory. He recommended the placing of two sets on each boiler, one set being used to check the other.

Mr. Chambers requested information regarding low and high water alarms. This was furnished by Mr. Huntress and Mr. Freeman, who referred to systems used at the West End Street Railway, Boston.

Mr. Hamilton spoke of the steam jacket. The principal objections to its use, he said, were not generally known.

Mr. Freeman supplemented his paper by a few remarks regarding the different forces of draft used with different coals, his opinion being that different coals required different drafts, dependent to a large extent upon the methods of firing, conditions of weather, and direction of wind. In concluding his remarks, he said that he had not devoted the time to the preparation of his subject that it deserved.

A hearty vote of thanks was tendered Mr. Freeman for his interesting paper.

The President then introduced Mr. MacKeen, who submitted the following paper on "Electric Meters":

ELRCTRIC METERS.

By R. T. MacKeen.

In selecting the electric meter as the subject matter of my paper, it was with a view to treat upon a subject that is probably of considerable interest to many of those present, and one which usually furnishes material for a large amount of discussion upon occasions of this nature, and with this fact in view I respectfully submit it. The history of the electric meter from its inception would certainly constitute very interesting reading, and a collection of the various types used in "ye olden days," as it were, would occupy a very prominent place in an electrical museum, even at this early date.

Many of us, no doubt, are familiar with the Edison chemical meter, the first successful apparatus, I believe, used for metering current supplied to customers. The principles upon which it is constructed constituted it an exceedingly accurate piece of apparatus. The trouble involved in determining its reading, however, has caused it to give way to the more easily handled Watt hour meter. Another disadvantage of the chemical meter which appeared prominently with the adoption of alternating current machinery, is that it registers upon direct currents only. In order to overcome this difficulty the ampere hour meter was devised, metering, as its name implies, the current only, giving a final result practically independent of the variation in voltage. An improvement in this regard, however, was the adoption of the Watt hour meter, which measures the total energy in watts, thus combining the relative instantaneous value of both current and E.M.F. As

the Watt hour meter is now used almost exclusively, my remarks will refer particularly to it.

The majority of our electric light and power companies in the maritime provinces are at present selling power under what is termed the flat rate system, i.e., a fixed charge per light per year, a method which will surely be superseded by the more correct method of measuring the power supplied each individual customer and charging so much per kilowatt. The advantages to the company of a meter system over the flat rate system are manifold. I feel, however, that it would be impossible to do justice to the subject in the short time at my disposal. In passing I might state, however, one result of the adoption of a meter system which appears very prominent, i. e., the increased capacity of a station due to a system of selling current by meters, or in other words, customers demand less capacity at the station to supply the average load in proportion to their maximum load.

The fact that cost of power to a consumer is based upon the actual consumption as recorded by the meter causes the customer to be less extravagant with light particularly than when using it under the flat rate system. The result is that the company can possibly carry 20% more load with the same machines under the meter system than when operating under the flat rate system. The gross receipts may possibly be less at first if the meter system is adopted, but the net revenue will bear a higher ratio to the operating expenses, the coal pile being materially reduced. It is therefore possible that there are some present who are considering the adoption of the meter system, as well as some who are already familiar with it, to whom a few remarks regarding the selection, testing, installation and inspection of meters may be of interest.

The adoption of any one make of meter is necessarily based upon one's experience with it. In lieu of this, however, I might say that there is little chance for mistake in obtaining meters from any of the well known electrical supply houses, as manufacturers are bound as a result of competition, to a certain extent, to place a good article upon the market. The advantages, however, that any one meter may possess over another can only be determined by actual experience with it, and for the preliminary steps in this direction we must have recourse to the testing department.

Every station, whether large or small, should be provided with apparatus for testing meters. The entire revenue depends upon them and they should be treated accordingly. The apparatus necessary for testing is not extensive, nor does it form an item of much expense. In direct current stations, the necessary instruments are usually at hand, namely, an accurate ammeter and voltmeter; a portable direct reading wattmeter, however, is necessary for alternating currents. A reliable stop watch is also necessary to complete the outfit. A bank of lamps, or a water rheostat for testing power meters, forms a load which can be varied easily over a wide range. The connections for testing are as follows: The ammeter or series coil of the portable wattmeter is placed in series with the meter under test, care being taken in case of the portable wattmeter to insert it on the service side of the meter. The v. m. or shunt coil of the portable wattmeter is then connected in multiple with the shunt coil of the meter. The load is then adjusted to the capacity of the meter under test, and the accuracy of the meter can be calculated by noting the load and seconds for any definite number of revolutions, as follows: $\frac{3600 \times \text{constant} \times \text{rev.}}{\text{seconds}} = \text{watts}$. The percentage of error either way is determined by the difference between the true watts as shown by the instrument and the value registered hy the meter. Another method is to put a known load upon the meter and allow it to run for an hour or so, the error being deduced from the difference between the known load and that shown by the meter; this method, however, involves time and necessitates great care in reading the dial, and is therefore objectionable.

Meters should he tested on $\frac{1}{10}$, $\frac{1}{2}$, full and 10% over load, the results being tabulated for future reference. Any error found upon testing can usually be remedied by moving the magnets toward the centre of the disc if meter is slow, or vice versa if fast, or in the case of some alternating current meters the drum or armature can be raised or lowered to accomplish the same result. A meter upon which testing and after adjusting does not record accurately to within 2% either way, both on full load and ½ load, should not be placed upon the line. It is rare, however, that new meters exhibit such a record after adjusting. Particular attention should be paid to the light load accuracy, as this usually forms the greater part of its load in actual service, and any inaccuracy on it affects the revenue on account of its longer duration more directly than the same inaccuracy on a variable load.

The meter begins its career upon being installed, and for satisfactory results depends to a large extent upon the care exercised in this regard. As a general rule, meters are placed just where the wireman elects to leave his meter loops, irrespective of the delicate nature of the instrument as well as the convenience of the meter reader and inspector. Vibration is a deadly enemy to the life of a lighting meter, having not only a tendency to render the meter fast, but by the reciprocating movement of the armature, scratches and ultimately chips the jewel. It, of course, requires time to effect the damage, but the meter is rendered inaccurate long before the jewel becomes useless. In connection with this, a good method of detecting vibration is to place a pencil between the teeth and touch the point to the wall, the slightest vibration being easily detected. It would be well if all the meters were installed as near the ground floor as possible. Any vibration would then be reduced to a minimum and the meter would also be subjected to a less variable temperature than if placed near the top of a building, the extreme of both heat and cold impairing its accuracy to a certain extent.

In connection with alternating current meters, some of those containing iron in their fields should not be placed upon inductive loads, such as motors or arc lamps having a low power factor, the tendency being to run slow. A method of overcoming this difficulty is to install two meters in series with each other, one being calibrated for a load of this nature or affected by it, the other being an ordinary meter. The difference in their readings at the end of the month will show the amount to be added to compensate for the error caused by the inductive load. Care should be taken in the case of meters installed on motor circuits that they are placed upon the service side of the switch, otherwise the field discharge of the motor is liable to injure the fine shunt windings by the alternate expansion and contraction of the wire, which chafes the insulation and ultimately ends in a short-circuit.

A mistake is often made in installing too large a meter for the number of lights without considering its light load accuracy. The meter of to-day will stand an overload of 20% for a brief period and will usually be found to register quite correctly upon it. Thus, in the case of house lights particularly, where the usual load is but from ½ to ⅔ of the maximum, a meter of such a capacity that this would be its full rated load could be installed, thus obviating the inaccuracy caused by running upon a light load were a meter of capacity equal to the maximum load installed. As stated before, light loads for long periods constitute the revenue producer, and particular attention should be given to the fact when installing the meter.

The mistake is frequently made of thinking that once a meter is calibrated and installed, it will go on recording accurately for an indefinite period without receiving the least attention. Such, however, is not the case, which is apparent upon a moment's thought. Dust and an accumulation of dirt upon the commutator in the case of meters with brushes, and particles upon the disc which come in contact with the pole pieces of the magnets, are conditions under which any delicate mechanism would fail to operate. It is almost impossible to prevent the ingress of dust, and sometimes insects, which make the meter their home without regard to potential present.

An annual inspection, at least while on the line, is therefore necessary. The meter should be thoroughly cleaned and overhauled and at the same tested under its normal running conditions and its reliability determined, future purchases being regulated thereby.

The meter merits our warmest sympathy. It is frequently the most abused piece of apparatus in existence. I refer to its character being so rudely mutilated by many customers whose anger have been aroused by some mistake usually effected by themselves. My experience has been that 9 out of 10 complaints are based upon some mistake which can be traced to the customer, who, however, loses no time in denouncing the meter as inaccurate without considering the matter in order to arrive at the truth.

A meter usually bears an unenviable reputation in the mind of the general public, the reason of which is probably due to the principal complainants, old flat rate customers, who having acquired the habit of burning light needlessly under the old system, find it hard to curtail when placed upon a meter. Their bills naturally in the winter months run up to an alarming height. A good plan when dealing with an intelligent customer is to make him familiar to a certain extent with the mechanism of the meter, explaining the method of reading the dials so that he may check

his own meter if he so desires. It takes but little time, and the result of enjoying the confidence of your customer fully justifies the time so expended.

In conclusion, I may say that my experience has been that a meter treated in a proper manner constitutes a most satisfactory and honest servant to the consumer and company in whose service it is employed.

DISCUSSION.

Mr. Chambers remarked that he had listened to the paper with much pleasure. He referred to the difficulty under which they labored regarding government inspection of meters. It not only formed a large item of expense, but was a drawback as regards testing meters while on the line, as the seals had to be broken, unless the meters were provided with windows. He said that he had recently received a pamphlet from the Canadian General Electric Company advocating the inspection and testing of meters four times a year. He thought that if meters required the amount of attention, as advocated by the pamphlet, they had better be abolished, as the inspector's fees and expense of removing meters from line would offset any advantages of a meter system over the flat rate system.

Mr. Huntress, while agreeing in a measure with Mr. Chambers, favored the government inspection of meters. The fact that a meter had been inspected, and its accuracy certified to by a representative of the government, relieved the company from the usual charges of fraud. The seal of the inspector settled at once any difficulty arising between customers and company. The quality of meters was improving, and consumers were becoming more cognizant of their value. Mr. Huntress also considered it good practice to make the consumer as familiar with the mechanism, etc., of the meter as possible.

Mr. Miller stated that he had tried for years to familiarize people with both gas and electric meters, and had failed to accomplish the desired results.

Mr. Chambers, referring to his previous remarks, said that he offered no positive objection to the inspection of meters when necessary, but questioned the necessity of so doing four times a year.

Mr. Miller, in supporting Mr. Chambers, said it was impossible to inspect them so frequently; it was not necessary, his experience having been that in the majority of cases meters, after two or three years' use, recorded as accurately as when installed, depending, of course, upon the location in which they were placed. Meters, he thought, were not as delicate as was generally supposed. He rel ited an instance where a meter, while being installed, fell a distance of 20 feet without impairing its accuracy to any extent.

Mr. Siebert also questioned the delicacy of the mechanism of a meter, expressing the opinion that manufacturers did not expect the instructions regarding the handling of meters to be taken literally. The precautions were to prevent careless people from subjecting them to extreme violence.

Mr. MacKeen took issue with both Mr. Miller and Mr. Siebert regarding delicacy of meters, supporting his contention by explaining briefly the theory of their operation.

Mr. Freeman expressed the opinion that meters might be tested and sealed by government officials at the works of the manufacturers, and thus save central stations the trouble caused as at present. Mr. Freeman also asked for information regarding the life of the meter.

Mr. Smith explained the reason why meters were not sealed by government inspectors at the factory. The main object of testing when received was to adjust any possible error in its accuracy, caused by rough handling during transportation.

Mr. MacKeen, in replying to Mr. Freeman, stated that the life ot a meter depended entirely upon the work imposed upon it, as far as the jewel was concerned. New jewels, however, could be inserted when necessary, the period of usefulness being practically unlimited.

Mr. Crosby, in reference to the accuracy of meters, cited instances where meters had been found perfectly correct after a continuous service ranging from two to three years.

Mr. Miller said that new jewels could be inserted without disturbing the government seal, in this way overcoming the expense of again sealing them.

Mr. Freeman then moved, seconded by Mr. Chambers, that a vote of thanks be tendered Mr. MacKeen. Carried unanimously.

Mr. J. H. Winfield submitted the following interesting paper:

THE LONG DISTANCE TRANSMISSION OF SPEECH.

By J. H. Winfield.

Long distance work is every day becoming a more important factor in the telephone business, and toll lines, instead of (as a few years ago) being regarded as mere accessories to the city exchanges, are now recognized as absolute necessities. We are talking over longer distances almost every month. A few years ago 500 miles was considered quite a feat; today we have conversations carried on over 1900 miles of wire with perfect ease. In view of this, it may not be amiss to speak of a few of the difficulties that are encountered in the design, construction and operation of these long lines.

The apparatus used in making a toll line connection may be divided into three parts: (1) the line; (2) the instruments; (3) the switching apparatus. The chief factor in extending the talking limit has been the improvement in the lines. Grounded circuits of iron wire are now practically obsolete, the recognized standard being a metallic circuit of hard drawn copper wire, generally No. 10 B. & S. weighing 170 pounds to the mile, but sometimes for short distances of No. 12 weighing about 104 pounds to the mile. The New York & Chicago line is constructed of wire weighing 435 pounds to the mile, but that is an exceptional case.

In speaking of the line I shall confine myself to the electrical rather than the mechanical difficulties that have been met with and overcome. Our object is to so construct the line and arrange the apparatus that the sounds at the receiving end shall possess the following characteristics: Loudness or volume; clearness; quality. Of these three clearness is by far the most important, for a faint sound, if clear, is perfectly intelligible, and a change in quality may only have the effect of disguising to some extent the speaker's voice. Volume is affected by any conditions which alter the amplitude of the wave.

Clearness is affected by any conditions which alter the position of the waves in regard to each other. Quality is affected by any conditions which alter the form of the wave. Therefore, the volume is reduced by resistance, leakage, static induction and self induction, the effect of these properties being to reduce the amplitude of the wave.

Clearness is reduced by static induction, and self induction, these tending to alter the inter-relations of the waves; static induction causing a rounding off of the top of the wave, thereby involving a loss of sharpness, while both static induction and self induction produce an unequal retardation of phase for vibrations of different periods, thus causing interference and a resulting deformed wave. In other words, the telephone current, being an alternating current of a frequency varying from 200 to 1,500 periods per second, according to the sound produced, static induction and self induction produce a greater retardation on the waves of high frequency than on the lower ones, thus mixing up the waves to some extent and rendering the speech muffled.

Quality is changed by all the properties which reduce the clearness, and by self induction in another sense as well, this effect of self induction being to reduce the amplitude of the overtone waves to a greater extent than of waves of a longer period.

Evidently then, in order to accomplish good telephonic transmission of speech, we must make the self induction and electrostatic capacity of our line and apparatus as low as possible, resistance and leakage being of less importance, though, of course, they should not be lost sight of. A small and well distributed leakage is often an advantage, as it allows the static charges to escape, clearing the line and to some extent neutralizing the effect of capacity, the slight loss in volume being more than counterbalanced by the gain in clearness. When iron wire is used there is a much further deformation of the waves than is caused by the increased resistance, due to the fact that the wire is circularly magnetized and this magnetism has to be reversed twice in every vibration. There is also a considerable increase in self induction due to the magnetic properties of the metal.

The self-induction of a copper metallic circuit of No. 10 or 12 wire is very small, but the self-induction of the apparatus which always forms part of a telephone circuit is sometimes very high and has a considerable effect on the current. Long distance lines would be particularly liable to disturbance from cross-talk if no means were taken to prevent it. There are two cases in which cross-talk will not be produced on a metallic circuit by a neighboring wire. The first is when the disturbing wire is at an equal distance from each of the wires of the metallic circuit. Were it always possible to string wires in this manner, there would be no trouble from cross-talk ; but a little consideration will show that this is only possible for two circuits. The second method is known as transposing. The two wires of the metallic circuit are transposed at regular distances, or, in other words, they change places, A changing to the pin B was on and B going to the pin A was on, the effect being to place each wire of the circuit at an average distance from the disturbing wire or wires. As the number of wires on a pole increases, the difficulty of planning the transpositions increases also. With two circuits it is an easy matter ; if, however, we have a third and transpose it, the same as we did the second, there will be cross-talk from the second to the third, because their relations to each other are the same as if there had been no transpositions at all. To get over this difficulty we must transpose the third twice as often as we did the second. A fourth circuit may be transposed at the middle points of the third, and so on. It has not been found necessary to transpose each circuit so that the induction currents are exactly balanced, and it is possible to use the same transpositions for every second crossarm, so that the first, third and fifth are alike, also the second, fourth and sixth. Transpositions are usually placed half a mile or a mile apart.

There has been very little change in the instruments in the past few years. The transmitter usually used is of the "Hunning's" type, and is known as the solid back ; it does its work remarkably well. Some of them require a little attention now and then on account of the packing of the carbon granules, but a judicious tap generally puts matters to rights. The ringer magnets of the call bells should be wound to a resistance of 1,000 ohms on long spools, bringing the wire close to the core, and thus giving them a high co-efficient of self-induction, which effectually prevents any shunting of the high frequency telephone current, while allowing the ringing current to pass freely, the ringers being bridged across the circuit.

In order to connect a metallic circuit to a grounded line, what is known as a repeating coil or transformer must be used, otherwise the balance of the circuit would be destroyed and the line become noisy. This piece of apparatus is nothing more than a specially made induction coil, the metallic circuit being connected to the primary and the grounded line to the secondary, the other end of the secondary being put to ground. In connecting together two metallic circuits through an intermediate office, the connections should be so arranged that the lines are directly connected, and the two transformers cut out ; otherwise, as a transformer only has an efficiency of from 85 to 90%, there would be a serious loss in volume.

All apparatus at intermediate stations should be bridged across the lines and the parts that are permanently in connection should have a high self-induction in order to avoid shunting the telephone current when the line is being used to stations farther on. Ring off drops should be wound to 1000 ohms resistance and also bridged. It is a good plan to use a tubular drop, as it not only increases the self-induction, but it also tends to prevent cross talk between the coils themselves, which is a frequent cause of disturbance and often not suspected.

Long distance lines should always be well equipped with protective devices. The best form for protection from lighting consists of two carbon blocks, separated by a thin sheet of perforated mica, one block being connected to line and the other to ground. These have proved very efficient and when properly installed generally prevent any damage to instruments or transformers. They also prove useful in another respect, as the static charges seem to find their way across from one plate to the other, clearing the line to a great extent. Many lines could be improved by a judicious use of these protectors at different points, such as the way stations. A fuse is also generally inserted in order to prevent the entrance of heavy currents which might otherwise do considerable damage, when, as sometimes happens, an electric light or power wire comes in contact with the circuit.

In regard to the operation of toll lines, long distance telephony is much more expensive than telegraphy, as may easily be seen when we consider that a single iron telegraph wire can easily transmit forty messages per hour, and when duplexed the number is doubled ; whereas in the telephone work we have to use two wires, and they must be of copper instead of iron, and even then under the best conditions it is hard to get more than seven or eight messages through in an hour. Add to this the fact that the sender of the message is aware of every minute of delay, and is usually very impatient when he has to wait a few minutes for the line, where in sending a telegram he just hands it in at the office and thinks no more about it, even though the message may not be sent for half an hour or longer, and it is easily seen that not only must the telephone message cost more than a telegram, but the lines are apt to be choked with business during a few hours in the middle of the day and comparatively idle the rest of the time. A great deal can be done by keeping the subscribers posted in reference to the hours when the lines are rushed, and very often they can so arrange their business that it will not come in the rush hours. They would thus save themselves the annoyance of having to wait for a connection and the lines would be worked more steadily.

DISCUSSION.

Mr. Hamilton opened the discussion by referring to the valuable character of the paper. He expressed his surprise that telephonic communication between cars on trains had not become more popular.

Mr. Freeman stated that telephones were used for that purpose in Pennsylvania, U. S.

A vote of thanks was tendered to Mr. Winfield for his paper.

The President then introduced Mr. Pickles, who submitted a paper giving a brief history of electric lighting in Halifax :

HISTORY OF ELECTRIC LIGHTING IN HALIFAX.

By W. Pickles.

The first electrical lighting in the county of Halifax for other than experimental purposes was an isolated plant owned and operated by the Dartmouth Rope Walk Co., of Dartmouth. It was not till the year 1881 that it was used in Halifax, and then only for an exhibition ; thousands of people thronged the wharf of Lawson Harrington, where the dynamo was in operation, but owing to an open circuit the exhibition was not the success anticipated.

About a year later a company was formed, under the name of the Halifax Electric Light Company—Mr. J. Logan, superintendent—with a station on Black's wharf. The installation consisted of one T.H. arc machine and ten arc lamps, shortly increasing to thirty-five street lamps and forty commercial, at the same time installing one Siemens alternator with a capacity of fifty incandescent lamps. This machine was used to light the Halifax Club.

In a few months it became evident that the present station was much too small to meet the growing demand for this new system of illuminating. The company decided to erect a larger and more modern station at the Three Mile House, at the outskirts of the city.

About this time the Halifax Gas Company decided to enter the field of electrical illumination, and with this in view purchased the apparatus, rights and good-will of the Halifax Electric Company. They immediately increased the capacity of the plant by the addition of two 50-light Wood arc machines. Strange to relate, however, within an exceedingly short time another company was formed under the name of the Chandler Electric Light Company. This company commenced operations with two stations, one situated at Messrs. Henderson & Pott's paint factory, and the second one at Dempster's planing mills. Their plant consisted of Ball machines, operated by the engines of the respective factories, the

company being successful in securing the contract for the street lighting of Halifax. After being in operation for a short while, they decided to remove their apparatus to the head of the Northwest Arm, where water power was used when available; but, owing to the scarcity of water, steam was almost exclusively used. After operating this station for about a year, and not being as satisfactory as expected, they again moved their apparatus to Black's wharf; after a brief period of time and owing to uncertain conditions, they changed their name to the Halifax Illuminating & Motor Company.

The gas company at this time were operating incandescent lamps, and the Halifax Illuminating & Motor Company, in order to successfully compete with them, decided to install incandescent apparatus, which necessitated their removal to Moran's wharf, where more spacious accommodations were acquired.

Halifax at this time was laboring under the unsatisfactory service rendered by the horse car system of transit, and Halifax promoters, inspired by the successful operation of electrically equipped street cars, formed a company under the name and title of the Halifax Electric Tramway Company, for the purpose of converting the motive power to that of electricity. In order to centre the electrical industries, arrangements were completed whereby this new company absorbed the Halifax Illuminating & Motor Company, thus combining the incandescent and arc lighting systems with that of the street railway. The wisdom of this is evident from the fact that the operation of street railway in conjunction with incandescent and arc lighting systems reduces the cost of operation to a minimum. It must be borne in mind that the gas company was still operating the Three Mile House plant and a sub-station at the gas works, the electrical department being under the supervision of Mr. P. R. Colpitt.

Shortly after the formation of the Halifax Electric Tramway Company, a new company appeared upon the scene, under the name of the People's Heat & Light Company, which finally absorbed the Halifax Gas Light Company and erected gas works on the Northwest Arm. This company disposed of the electrical apparatus previously operated by the gas company to the Halifax Electric Tramway Company, thus further combining the electrical interests.

In conclusion, it may be of interest to those present to give a brief description of the apparatus at present being operated by the Halifax Electric Tramway Company, under the management of Mr. F. A. Huntress. The apparatus consists of 900 k.w. for railway, 800 k.w. for incandescent work, and 250 k.w. for arc lamp service, operating thirty-two cars, 14,500 incandescent lamps, 240 arc lamps, and 300 h.p. in motors.

I have endeavored to give a brief history of the many changes that have taken place in the electrical industries of this city, and feel that it is impossible to do justice to this subject in so short a paper. If it has proved of interest to any present the object has been fully realized.

DISCUSSION.

Mr. Colpitt, in commenting upon the paper, stated that it brought many old recollections to mind. He related some interesting anecdotes in connection with regulating the voltage of an old Siemens alternator, a reel of iron wire with a poker as a contact maker being used in lieu of a regular rhoestat.

A hearty vote of thanks was then tendered to Mr. Pickles.

Mr. Bowman, in concluding the business of the convention, expressed his pleasure that so many valuable and interesting papers had been submitted. He felt that if the present interest manifested were sustained the Association would enjoy a long and brilliant career.

The President then declared the convention adjourned until next annual meeting, the date and place to be announced later.

THE BANQUET.

In the evening the Halifax members tendered the visiting delegates a banquet at the New Victoria Hotel. The arrangements were complete, and the unanimous opinion was that the affair was a great success and a fitting conclusion to the convention. Amid pleasing decorations the company sat down to dinner at 9 o'clock, when the following repast was furnished:

MENU.

"High Potential Transformer."
George's Island Punch. 30,000 Volts.

SUBMARINE CABLES.

Oysters on the Deep Shell. Consomme a la Nova Scotian.

TROLLEY POLES.

Baked Philadelphia Trout, Sauce Piquant.
Windsor Potatoes, "Self Regulating."

INDUCTIVE LOAD.

Queen Olives, "Rubber Covered." Lettuce.
Fillet of Beef, with Mushrooms a la Lyonnaise,
Croquant of Lady's Fingers, with Charlotte Russe.
Tutti Frutti with Whipped Cream.

SHORT CIRCUITS.

Westphalia Ham. Champagne Sauce "a la Overload."
Ox Tongue, Pecking Sauce, "High Potential."

JOINTS, "Soldered and Taped."

Haunch Prime Western Beef. Dish Gravy, "Lubricating."
Young Turkey, "Low Resistance." Oyster Dressing
Lemon Jelly, "Insulating Compound.

HEAVY GROUNDS.

Whole and Mashed Potatoes, a la Creme.
French Peas, "Copper Plated." Bermuda Onions, "High Permeability." Beets

SHUNTS

Mayonnaise Jelly, "Vibratory." Lobster Salad, "Iron Armoured.

BOOSTERS.

English Plum Pudding, "Sound Proof." Sauce Cognac, "Circuit Breaker.
Snow Ball Pudding, "Light Load." Soft Custard, "X Ray.
Apple Pie, "Rubber Belting." Lemon Meringue Pie.

DESSERT.

Vanilla Ice Cream, "Self Ventilating."
Assorted Cakes, "Polyphase Currents."
Apples. Oranges. Layer Raisins, "Shellaced."
Nuts and Bolts. Confectionery, "Insulators."
ELECTRIC HEATERS—Cafe Noir, Tea.
BLOW LAMPS—Cigars, "Soft Cured."

CHANGE CARS! TROLLEY OFF!! LINE DOWN!!!

TOASTS. SPEECHES.

President-elect Huntress occupied the chair. An informal toast list included "The Queen," "Our Past-President," "Our Guests," and "The Newly-Elected Officers," each of which brought forth fitting responses. Messrs. N. L. McDonald, C. Mitchell and A. Norman favored the company with songs, and music was discoursed by the Mystic orchestra.

MOONLIGHT SCHEDULE FOR MAY.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 7.20	A.M. 1.40	6.20
2....	" 7.20	" 2.20	7.00
3....	" 7.20	" 2.50	7.30
4....	" 7.20	" 3.20	8.00
5....	" 7.30	" 3.50	8.20
6....	" 7.30	" 3.50	8.20
7....	" 7.30	" 3.50	8.20
8....	" 7.30	" 3.50	8.20
9....	" 7.30	" 3.50	8.20
10....	" 7.30	" 3.50	8.20
11....	" 7.30	" 3.50	8.20
12....	" 7.30	" 3.50	8.20
13....	" 7.30	" 3.50	8.20
14....	" 10.20	" 3.50	5.30
15....	" 10.50	" 3.40	4.50
16....	" 11.00	" 3.40	4.40
17....	" 11.20	" 3.40	4.20
18....	" 11.50	" 3.40	3.50
19....	....	" 3.40	3.30
20....	A.M. 12.10	.....	
21....	No Light.	No Light.	.....
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	No Light.	No Light.	.....
25....	No Light.	No Light.	.....
26....	P.M. 7.40	P.M. 10.10	2.30
27....	" 7.50	" 11.00	3.10
28....	" 7.50	" 11.40	3.50
29....	" 7.50	A.M. 12.10	4.20
30....	" 7.50	" 12.50	5.00
31....	" 7.50	" 1.00	5.50
		Total........	155.10

Tenders were recently invited for the supply of an electric light plant for the new municipal buildings, Toronto. The Canadian General Electric Company were the successful tenderers, their price for a 100 k. w. generator being $4,287. The contract for electric wiring was given to the Bennett & Wright Company, at $2,250.

THE ELECTRICAL INDUSTRY IN BRITISH COLUMBIA.

A visitor to Toronto within the past month was Mr. L. A. Campbell, manager of the West Kootenay Power & Light Co., of Rossland, B. C. Mr. Campbell also spent a few days in Montreal, in consultation with some of the directors of his company. Talking with a representative of the ELECTRIAL NEWS, Mr. Campbell stated that many of the mines in British Columbia had lately been closed down for the purpose of increasing their equipment, and that in a short time they would be turning out ore in large quantities. Operations were being carried on day and night, eight hour shifts being employed. He remarked that much electrical apparatus had been installed in British Columbia during the last two years. At Rossland, for instance, motors of a total capacity of 2,600 h.p. were now connected up, the power being used for lighting and hoisting purposes. A 300 h.p. hoist was now in operation at one of the mines, and the owners of the Le Roi purposed putting in one of 500 h.p. The plant of the West Kootenay Power & Light Co., which supplies light and power almost exclusively for mining operations, has been steadily in operation since July last, and Mr. Campbell states that no trouble whatever has been experienced with climatic conditions. The distance from the power station to the sub-station at Rossland is thirty-one miles, but a motor is fed four miles beyond the sub-station, making the entire distance from point of development to end of distribution line thirty-five miles. The line passes through a rough section of country, including many high hills. It was learned that the West Kootenay Power & Light Company are about to install another 2,000 h.p. machine, thus doubling their capacity, this course having been rendered necessary by the steadily increasing demand for power. It is also the purpose of the company to extend their line to the boundary country and Greenwood Camp, seventy-two miles distant from the generating system, for the purpose of supplying power for the different mining properties in that district. In this connection it is interesting to learn that it is contemplated to use a pressure of 34,000 volts, the highest yet attempted in Canada. Mr. Campbell will look over the ground at an early date and report to the directors of the company.

POLE SETTING.

No definite rule can be given for the depth at which poles should be set in the ground. The character of the soil, the distance between poles, the number of wires carried, and the sharpness of the turns made in the line must all be considered in determining this question. For average work we would point out the following table, which we believe to be in accordance with the best practice :

25	foot	pole	5½	feet	in	ground.
30	"	"	6	"	"	"
35	"	"	6	"	"	"
40	"	"	6	"	"	"
45	"	"	6½	"	"	"
50	"	"	6½	"	"	"
55	"	"	6½	"	"	"
60	"	"	7	"	"	"
65	"	"	7	"	"	"
70	"	"	7½	"	"	"

Where the ground is bad, or where the conditions are very severe, the holes should be larger than usual, and about six inches of concrete, composed of broken stone, sand and enough cement to bind them together, should be placed in the bottom. The pole should then be put in place and the hole filled in with the same mixture, which should be thoroughly tamped into place.

It sometimes happens that a pole cannot be set deep into the ground on account of some sewer, subway or other obstruction. In such cases the hole should be dug as deep as possible, and considerably larger than would ordinarily be necessary. The pole should then be set in place and its end thoroughly embedded in a mass of stone and cement entirely filling the hole. If the strain is at all severe, the pole should be thoroughly guyed in addition to the above precautions.

Great mistakes are often made in laying out pole lines by introducing unnecessary turns in the line. It should be remembered that where a line is straight the tendency of the wires when properly strung is simply to press the poles deeper into the ground. But where a bend occurs in the line an enormous side strain is present which tends to either break or loosen the pole. The magnitude of these strains can only be appreciated by those who have had actual experience in this work.

In running a line over undulating country it should be borne in mind that the poles in a hollow of the ground should be long and those on elevated positions comparatively short, the object being to avoid very great upward and downward curves in the wire. Where this precaution is neglected it is frequently found that the insulators are pulled off the pins and dangle several feet above the cross-arms, and frequently a short pole in a low position is pulled entirely out of the ground.

The butt of the pole should always be squared before setting.—The Telephone.

THE MEASUREMENT OF HIGH RESISTANCES BY THE WHEATSTONE BRIDGE.

By A. O. BENECKE.

High resistances are usually measured by the deflection method, as the range and the insulation resistance of the Wheatstone bridge is not sufficient for this purpose.

It is, however, possible to use the Wheatstone bridge method for measuring resistances up to a thousand megohms even with greater accuracy than obtainable by the deflection method by simply measuring the high unknown resistance in multiple to another suitable resistance.

Suppose we have a five dial bridge and a resistance of say about 100,000 ohms. We can measure this resistance on the bridge accurately to single ohms. It may measure A ohms. Now we place the unknown high resistance in multiple and find the combination is balanced by B ohms. Then we have

$$\frac{A.\,x}{A+x} = B, \text{ or } x = \frac{A.\,B}{A-B}$$

In this result a surface leakage of the bridge is eliminated, as it is already contained in A.

In case A = 99988 ohms and
B = 99978 ohms, we find
x = 1,110,722,254 ohms, or
1,1111 megohms.

This method of measuring an unknown resistance in multiple arc to another one will be found also very useful for the measurement of such resistances which otherwise would necessitate the employment of ratio coils widely differing in value. The sensibility of the galvanometer, and therefore the accuracy of the measurements on the bridge, is, as it is well known, the greatest if the four arms of the bridge are of the same resistance, i. e., if the ratio of the proportional coils is 1. If we want to make our measurements under these best conditions the range of a five dial bridge would be limited to 10,000 ohms. For the measurement of 1 megohm, we would have to use the ratio 100 : 1, but measuring the 1 megohm in multiple to 10,000 ohms we still could use the ratio 1 : 1.

MONTREAL

(Correspondence of THE CANADIAN ELECTRICAL NEWS.)

FOOD FOR THOUGHT.

A leaflet entitled "Food for Thought" has come before the notice of your correspondent. It consists of some extracts from remarks made by the Chairman of an Electrical Contractors' Association in an American city. Judging by the figures submitted for electrical work in Montreal, it is equally applicable to this side of the border. For instance, when tenders were opened a few days ago for the wiring of a public building, one tender was $250, another $235, and the third, and needless to say successful tender, was $79. I am credibly informed that the material alone for the work cost the contractor over $100. Let me give you another instance: Four tenders were submitted, $10,000, $9,500, $8,200 and $3,600. The latter tender was, of course, accepted, but the compliers of same found that they had missed a "small item of $6,000," much to their subsequent sorrow. Herewith are given extracts from the leaflet, which I seriously recommend to the electric wiring contractors of Canada:

"I should like to make a few general but not personal remarks before opening for regular business.

A few of the members are old-timers in the business, and I think they will bear me out in some of the statements I am about to make.

I think I can truthfully say that $150,000.00 will not cover the losses in the electrical fraternity, during the past few years, in this city alone.

There was a time when this business was a profitable and pleasant one. What is it now? You may possibly be grubbing out an existence—no more. Undoubtedly some are glad to get that. I am for one. At the rate you are going you will not be able to gather that in, in a very short time.

It is the old story told and re-told—a lesson taught but never learned. It will not take long to tell why we are now at the bottom of the ladder; round by round we have gradually descended. Low prices for material and for work have been the ruination of several in this city, and many in other cities.

The old worn-out saying so familiar to the old-timers, running something like this—"I will do up this and that concern, and soon I will be alone in the field to reap the benefit of my shrewdness." This makes the old-timer smile, for he knows that he has helped bury more than one.

The method adopted by the new-comer to him seems new. It is—as he reasons with himself—I am new on the ground and to get business and a little reputation I will cut the prices. I will do the job at cost.

What does the old-timer do when he sees trade drifting away. He cuts also, only a little more. The student has his war-clothes on and he proposes to show that he is no chump, and he goes one better. Down the ladder you go and the fight goes merrily on. What is gained? Nothing—the prices are down and never to be brought back. What is the next step—some one gets tired, is running behind with his credit, and a bold stab is made. Call on the stockholders, fire the worn-out partner, get a new partner or shut up shop. And the band still plays on. If one concern digs a big hole, crawls in and pulls the hole after him, he is not missed, but he is not forgotten. The warriors left on the field of battle are resting up. Along comes another, green in the business, but seeing fabulous wealth in a business that is still in its infancy, dumps his load of dollars in the hopper, and with the keen scent of a tried and true fighter follows in the steps of the departed.

Same old story that makes us all weary is again gone over and the fittest survives, but badly wounded. After all the wasted years you have laid nothing by; you are poorer in pocket and health, and you are finally carried to your long, last resting-place and the head-stone over your grave should be lettered—A life wasted in the electrical business that future generations can look with reverence on the burial place of one who fought well but not wisely.

Undoubtedly I shall be the first one of members present who will retire from the field, but do not think that my place will not be taken. I will not be missed—but I can rest on my oars and look back at the poor deluded mortals fighting and worrying for their daily bread in a business that has been ruined in its infancy. There is but one more round in the ladder for you to descend and then you are on the last; grip that and thank God that you are alive."

NOTES.

Mr. R. A. Ross, E. E., of this city, has left for a three months sojourn in China, where he will be in consultation with Sir Charles Ross re electric power transmission in that country.

I note that Prof. Carus-Wilson, recently head of the Electrical Department of McGill University, Montreal, has taken an active part in recent discussions at the Institution of Electrical Engineers in London, Eng.

Mr. W. J. Plews, assistant to Mr. Badger, the expert for the Fire Underwriters Association in this city, has lately got out a form of main switch, or what at sight might erroneously be termed a circuit breaker. He has the article patented in five countries, and is likely to make a good thing out of it, as those who have seen it practically tested speak very highly of it. It opens with excess of voltage, even on one side. It will thus be seen that it is invaluable as a precaution when a transformer breaks down or when a high voltage line of any kind falls across the house mains.

QUESTIONS AND ANSWERS.

"F. B." writes: Will you kindly have the following question answered through the columns of your valuable paper: I have an E. P. Allis 14 x 36 Corliss condensing engine, of which the crank end valve carries (not released) over 5 h.p. before the head end. Card at proper load shows lead, compression, etc., all right. Of course, the crank end doing less work than the head end might cause it on overload to carry over first, but should there be the above difference? Can it be remedied except by changing cams?

ANSWER.—As we understand the question, you wish to know if the difference in the horse power developed at the two ends is greater than it should be. With an engine of this size, the difference is scarcely greater than might be expected, and we do not think there is anything seriously wrong with the engine.

"Re-Winder" writes: In an induction fan motor, can you tell me if a change in frequency would mean more or less copper bars inserted through the squirrel-cage rotor? Am trying the experiment of making 16,000 A. fan work on 8,000 A.

ANSWER.—The "squirrel-cage" rotor would be the same for both frequencies, but we do not think that the change as proposed is commercially practicable. It would cause the motor to heat beyond a safe point, due to the greater magnetic flux which will be necessary, and to the somewhat increased current taken. It will also be found that the speed will be a little less than half of what it should be to give a reasonable breeze.

DIFFERENCE BETWEEN THE NOW AND THEN.

Prof. Elisha Gray delivered an address at a recent convention of the Northwestern Electrical Association at Duluth, entitled "Reminiscences and a Glimpse into the Future," in which he introduced the following verses:

In the olden time along the street,
A glimmering lantern led the feet,
When on a midnight stroll:
But now we catch when night is night,
A piece of lightning from the sky
And stick it on a pole.

Time was when one must hold his ear
Close to the whispering voice to hear,
Like deaf men near and nearer;
But now from town to town he talks,
And puts his nose into a box,
And whispers through a wire.

In other days we took a car,
Drawn by a horse if going far,
And felt that we were blest:
But now the conductor takes the fare
And sticks a broom-stick in the air—
The lightning does the rest.

Just as we go to press we learn of the death of Mr. Donald Gibson, city electrician of Toronto, in his 74th year. Mr. Gibson entered the city service in 1872, and was one of its oldest employees. Under his superintendence the excellent fire alarm service in use was developed, and brought to its present condition.

The Dominion Publishing Company of Toronto have just completed a handsome publication entitled, "Canada from Ocean to Ocean." The work is descriptive of the resources of the various provinces of the Dominion, and is liberally illustrated with many beautiful engravings of the public buildings, leading industrial establishments, etc., throughout Canada. We understand that the publication of this work, which is in every way creditable to the publishers, is approved and assisted by the Dominion and provincial governments, and the leading municipal corporations. It will be placed in the Boards of Trade and public libraries throughout Great Britain and Canada, on the leading steamships, and in other places where it will be likely to prove a valuable advertisement for this country.

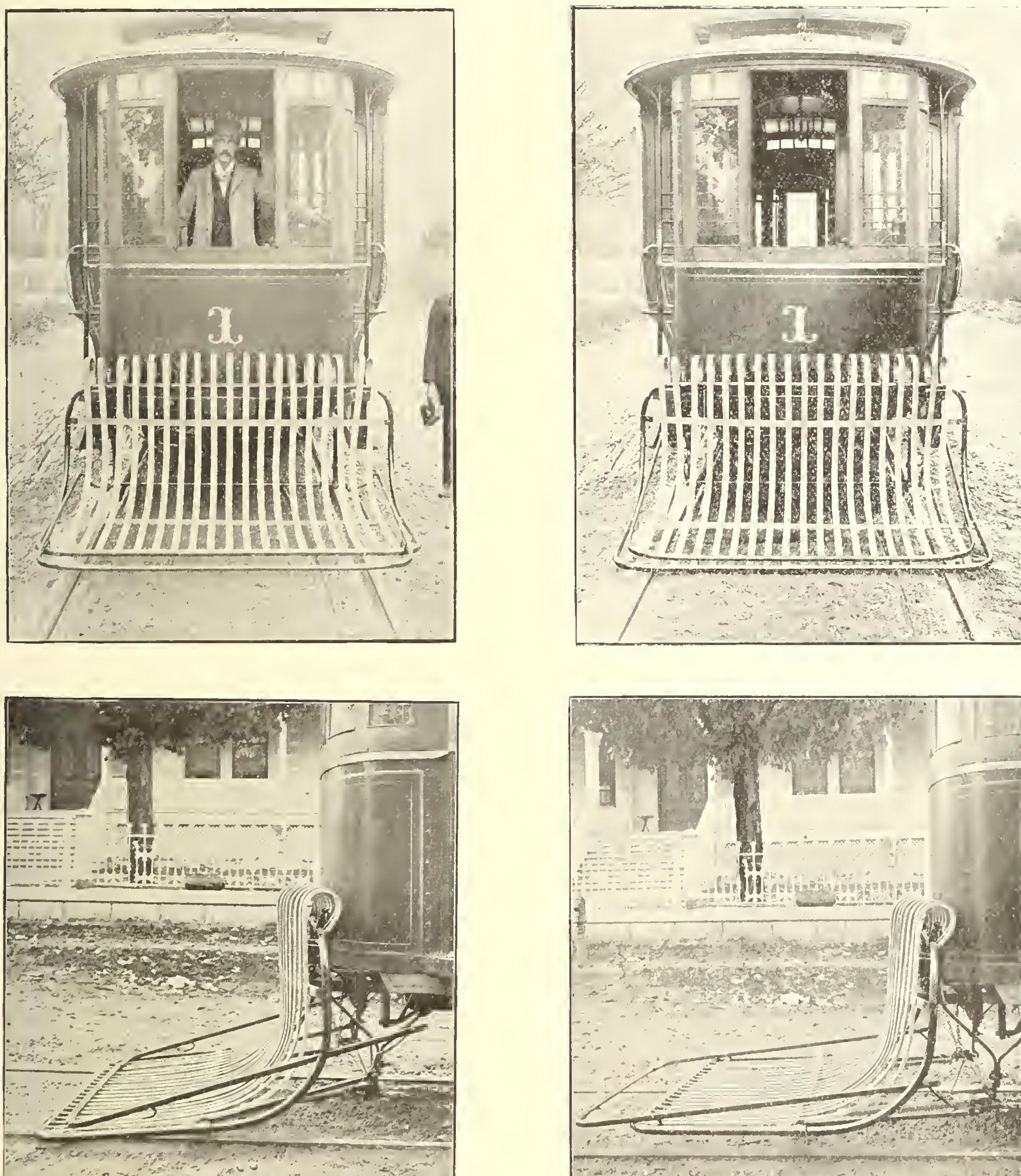
ELECTRIC RAILWAY DEPARTMENT.

AN IMPROVED STREET CAR FENDER.

On this page illustrations are presented of an improved street car fender invented by Mr. Geo. Sleeman, and manufactured by the Geo. Sleeman Fender Co., of Guelph, Ont. From the views shown the reader will clearly understand its construction and operation.

The fender is positively automatic, an advantage which it is claimed to possess over all other fenders in use. In front of the fender is a projecting guard, by which it is rendered automatic. When the fender is carried the usual height from the track, say eight inches, the guard projects about one foot. When this guard comes in contact with any obstacle, it is driven back, and the fender falls quickly to the track, thus preventing the obstacle from being passed over by the car. The fender is always down to the track before the object is reached, the fall being quickened by the tension of two strong spiral springs. By pulling the guard forward when the fender is down, the fender rises to the proper height from the track, where it remains until the guard is again struck.

This fender has been favorably received and commented upon by street railway people. It is used on the cars of the Guelph street railway, has been recommended to the Toronto Street Railway Company by the city engineer, and within the past fortnight the manufacturers have closed a contract to equip with this fender all the cars of the Winnipeg street railway system.



Views of Street Car Fender, Invented and Manufactured by Mr. Geo. Sleeman, Guelph, Ont.

One hundred open cars of new design are being built at the shops of the Montreal Street Railway Co. Besides adding extra cars, the company intend making them longer, with the result that the trailers will gradually become obsolete. This summer the company will build car shops at Hochelaga and also extend the system to Verdun.

CANADIAN ELECTRICAL STUDENTS' COMPETITION.

The publishers of the CANADIAN ELECTRICAL NEWS hereby offer a first and second prize of $15 and $10 respectively for the best thesis submitted by an undergraduate of a Canadian university on any one of the following snbjects, viz. :—

1. "The Magnetic Circuit of Dynamos."
2. "The Incandescent Electric Lamp."
3. "The Electric Meter."
4. "The Relative Advantages of Low and High Frequency in an Alternating Electric Lighting Plant."
5. "A Concise Description of a Method of Testing Transformers for Efficiency at Various Loads, both as Regards Regulation and Core Loss."
6. "Comparison between Two and Three Phase Installations for the Long Distance Transmission of Power."

It is required that each thesis submitted in this competition shall consist of not less than 5,000 nor more than 6,000 words, and shall be written in the third person, and typewritten for publication on one side only of foolscap paper.

To admit of a fair comparison of the merits of the theses which may be submitted, keeping in view variety of subjects, a system of marks will be employed such as is generally used in college examinations, and with which the competitors in this competition are familiar. These marks will be allotted under three heads, viz.:—

1. Subject Matter.
2. Arrangement.
3. English.

Taking 100 as the combined total, the maximum and minimum marks for each of the above classifications will be as follows :

Maximum.		Minimum.
50	Subject Matter	25
25	Arrangement	15
25	English	15

If any of the theses submiited should not be entitled to receive the minimum of marks as above, they will be entirely rejected.

There are three sources from which competitors must draw their subject matter, viz., books, periodicals and floating literature, personal or private channels. In judging of the subject matter, the following relative values will be attached to the above mentioned sources of information :

(a) Books	10
(b) Periodicals and floating literature	20
(c) Personal or private sources	20
	50

Where extracts are used, their source and names of authors should be clearly given.

Where diagrams are required to illustrate the text, they should be drawn with pen and perfectly black ink on pure white drawing paper, bristol board or tracing linen, and in such manner as to admit of their reproduction to a small scale.

Each thesis shall be submitted by motto only, and shall be accompanied by the name of the author enclosed in a sealed envelope bearing the same motto. This envelope will remain sealed in the hands of the publishers until the competition shall have been decided.

Theses submitted in this competition must reach the C. H. Mortimer Publishing Company of Toronto, Limited, Toronto, Ont., publishers of the ELECTRICAL NEWS, before the first day of October, 1899.

A competent judge has been chosen to decide the competition in accordance with the method explained above. This gentleman, whose name will be given at a later date, will no doubt be acceptable to all concerned.

The result will be published as soon as possible after the close of the competition.

The publishers of the ELECTRICAL NEWS reserve the right to publish such of the theses submitted as in their judgment may appear to be desirable for that purpose.

SPARKS.

The Montreal Street Railway Co. have placed an order with the Canadian General Electric Co. for twenty C.G.E. 1,000 railway motors.

Provincial legislation will be sought to permit towns in Manitoba to install and operate electric light and telephone stations for commercial purposes.

The Canadian General Electric Company have just received an order from the Rubber Tire Wheel Co., of Springfield, Ohio, for a complete tire welding plant.

The Winnipeg Street Railway Co. have placed another order with the Canadian General Electric Co. for 18 of their standard C.G.E. 1,000 railway motors.

The amalgamation is announced of the Lakefield electric lighting plant and the Burleigh Falls-Lindsay electric power scheme, the promoter of which is Mr. J. A. Culverwell, of Toronto.

The Canadian General Electric Co. have received another additional order from the Montreal Cotton Co., of Valleyfield, Que., for one 200 h.p. and one 100 h.p. induction motors, also for one 20 h.p. motor of the inverted type.

The Royal Electric Company are installing in the works of the Hamilton Bridge Company one of their 40 h.p. two phase induction motors for operating the cranes and machinery. The works are also being lighted throughout by electricity.

The Toronto Electric Light Co. has entered an appeal in the Court of Appeal against the decision of the jury in the recent Civil Assizes awarding W. G. Harris $10,000 for a fire in his factory, alleged to have been due to a defective electric wire.

The Lachine Rapids Hydraulic & Land Co., of Montreal, have, during the past 30 days, ordered from the Canadian General Electric Co. induction motors of the following sizes: one 100 horse power, four 5 horse power, two 3 horse power, and two 2 horse power.

The Lunenburg Gas Co., of Lunenburg, N.S., through their manager, Mr. E. L. Nash, are now offering to supply the inhabitants of Lunenburg and Mahone Bay with electric lights. As soon as their new power works at Mahone are completed, they will supply an all night service.

The British America Corporation, who control the Le Roi and other valuable mining properties at Rossland, B. C., have decided to equip these electrically for power and hoisting purposes, and have ordered four 150 h.p. special three-phase induction motors and controllers from the Canadian General Electric Co.

In connection with the Y.M.C.A., Montreal, an electrical society has been formed, with Professor L. A. Herdt, of McGill College, as teacher. The new society will hold monthly meetings during the summer for discussion, excursions and visits to electrical plants. Professor Herdt is president, and Mr. James C. Bray secretary-treasurer.

To close out the estate of the Eastern Townships Light, Power & Carbide Company, of Sherbrooke, Que., tenders were recently invited by John J. Griffith, liquidator, for the entire electric plant of the system at present supplying electric light to the villages of North Chatley, Eustis, Capelton, Waterville, Compton and Lennoxville.

The Grand Trunk Railway Company have decided to extend their electric system in order to furnish light and power to their new freight sheds, as well as their present repair shops. For this purpose they have placed an order with the Canadian General Electric Co. for two 500 light direct curennt multipolar dynamos, complete with marble panel switchboards.

The Gurney-Tilden Company, of Hamilton, are having installed in their works, by the Royal Electric Company, one 50 h.p., three 15 h.p. and one 7 h.p. "S.K.C." two-phase motors, which are to drive the machinery and elevators in their entire works, entirely replacing steam. At this rate Hamilton will soon be a smokeless city, as the Hamilton Electric Light & Power Co. were closed down on March 5th, and have not been in operation since, everything being driven by the large S.K.C. motors with power from DeCew Falls.

The Water Commissioners of the town of Fort William, Ont., have purchased from the Royal Electric Company an additional S.K.C. two phase generator having a capacity of 200 kilowatts. Their lighting has increased so rapidly that the 75 kilowatt plant which was put in a year ago was not sufficiently large to supply the demand. They are also relamping a portion of the city and extending their lights. About 500 lights capacity of S.K.C. transformers are being put in. The changes will be made and the additional plant in operation about the middle of June, after which it is proposed to supply the requirements of the C. P. R. in their large passenger station, elevators, freight sheds, round houses, and the Kamanistiquia hotel. The growth of the lighting has been phenomenal, and has been taken care of by Mr. T. Ed. Oakley, secretary to the commissioners. The waterworks and electric light plant are in charge of superintendent W. H. Smith, formerly of Goderich, Ont.

PERSONAL.

Mr. Matthew Stanley, of Perth, Ont., has received the appoinment of superintendent of the street car shops of the Birmingham, England, tramway. This system is operated by a Canadian syndicate, Messrs. Wm. Mackenzie and James Ross being the chief members.

Mr. L. J. Breithaupt, manager of the Berlin Gas and Electric Co., has been chosen as the Liberal candidate to contest the riding of North Waterloo in the coming bye-election. The seat was made vacant through the unseating of the successful Conservative candidate, Dr. Lackner, of Berlin.

Mr. D. R. Logan, who was for several years connected with the Canadian Generel Electric Company and the W. A. Johnson Electric Company, has accepted a position with Mr. John Forman, dealer in electrical supplies, Montreal. Mr. Logan will act as travelling representative for Mr. Forman in Western Ontario, with headquarters in Toronto.

Mr. W. B. Chapman, who is interested in electrical enterprises in the West India Islands, returned to Montreal last month, after spending the winter in these British possessions. In Jamaica Mr. Chapman met Lieut. Col. Henshaw and Mr. W. Porteous, of Montreal, who are interested in the tramway system. Mr. Chapman states that upon his arrival in Kingston, the work on the electric tramway was well advanced, and that the citizens were delighted with the work the Canadian syndicate had done. The Kingston electric tramway is about twenty miles in length and twenty-eight cars are operated.

SPARKS.

The Canadian General Electric Co. have sold the West Kootenay Power & Light Co., of Rossland, B. C., one of their standard 50 h.p. three-phase induction motors.

The Guelph Light & Power Co. have placed an order with the Canadian General Electric Co. for one of their latest multipolar type 500 volt generators of 100 horse power capacity.

The Columbia Telephone & Telegraph Co., an American concern, will apply to the Dominion parliament for a charter to extend its system to all parts of British Columbia and the Northwest Territories.

The Metropolitan Electric Co. has been granted a charter for twenty-three years by the city council of Ottawa, Ont., for rhe supply of electricity for light and power purposes. The Deschenes Electric Co. have renewed their application for a charter, but the city council does not seem to be disposed to favorably consider it.

The John McPherson Company, Limited, manufacturers of boots and shoes, Hamilton, Ont., have placed their order for a 40 h.p. S.K.C. two-phase induction motor, which is to be used to operate their entire plant, replacing their present steam equipment. They are also having their factory lighted throughout by electricity.

The Cataract Power Co. have made a proposition to light the streets of Hamilton for ten years at the following prices: For the first 425 arc lights, $85 per lamp per year, and any additional lamps, up to 500, for $82.50 a year. If over 500 lamps are required at any time during the contract, the rate will be $82.50 for the first 500 light, and $80 for each additional lamp.

Mr. W. H. Kent, superintendent of the Vernon & Nelson Telephone Co. and the New Westminster & Berrard Inlet Telephone Co., states that important improvements to the system have been decided upon. An additional wire will be erected between New Westminster and Vancouver, and the old instruments replaced with more modern ones. A local exchange will be established at Greenwood City.

The Bell Telephone Co. is establishing a number of pay stations in Montreal on the nickel-in-the-slot principle. The instruments will be placed in drug stores, but the system will be distinct from the ordinary telephone in the store. The person who desires to use the instrument will call up central, but connection will not be made until five cents has been deposited in the slot.

The Lachine Rapids Hydraulic & Land Co. believe that the stealing of electricity is carried on to some extent in Montreal. In one instance, it is said to have been discovered that a saloon keeper who paid for about five lights had some twenty-five more put into his place, supplied by connections unknown to the company. Steps are being taken to prevent this practice. Under the new law of the State of Illinois, a conviction was recently obtained in Chicago by the Chicago Edison Co. Practical demonstrations of the use and measurement of electricity were given in court at the trial. Wires were connected on the witness stand with the electric wires of the building and apparatus attached. Expert electricians illustrated the art of "plugging," "cutting off," and "cutting in." The "cutting in" of the criminal court building wires and the flashing of a light full of force and brilliancy was considered a particularly apt and convincing illustration of how electricity might be stolen. The penalty in Illinois for thefts of this nature is a term of not more than three months in all and a fine not exceeding $500.

The town of Picton, Ont., opened tenders recently for additions to its electric lighting plant. The tenderers for alternators were the Central Construction Co., Buffalo; Canadian General Electric Co., Toronto; Royal Electric Co., Montreal; Munderloh & Co., Montreal; and Westinghouse Electric & Manufacturing Co., Pittsburg. For steam boilers the tenderers were E. A. Wallberg, Montreal; Robb Engineering Co., Amherst, N.S.; Babcock & Wilcox Co., Montreal; Goldie & McCulloch Co., Galt; and Central Construction Co., Buffalo. The tenderers on steam engines were the Goldie & McCulloch Co., Robb Engineering Co., and Central Construction Co. The Northey Manufacturing Co., Central Construction Co., Robb Engineering Co., and Goldie & McCulloch Co. tendered on pumps and condensers. For the supply of the complete equipment the only tenderers were the Canadian General Electric Co. and the Central Construction Co. The consulting engineer, Mr. Roderick J. Parke, of Toronto, has made a report to council, but the contracts will not be awarded until the by-law has been sanctioned by the ratepayers. A vote is likely to be taken early in June.

SPARKS.

The Bell Telephone Co. will probably put in a metallic circuit at Orillia, at a cost of about $7,000.

The formal opening of the new electric light plant at the Mimico Industrial School, near Toronto, took place a few weeks ago.

The Bell Telephone Co. will build a new copper metallic line between Arnprior and Ottawa. Work will be commenced immediately.

The Canadian General Electric Co. have received an order from the Strathroy Electric Company for a 25 kilowatt 500 volt generator of their latest type.

The E. T. Wright Company, of Hamilton, manufacturers of tin and stamped ware, are having their steam engine replaced by a 30 h.p. S.K.C. two-phase motor, receiving its current from the lines of the Cataract Power Company.

The road masters of the Toronto Railway Company recently tendered a complimentary banquet to their superintendent, Mr. Gunn, at McConkey's restaurant. Mr. Gunn has been associated with the Street Railway Company for over thirty years.

Capt. G. H. Couverette, of Montreal, has patented an electric grain shovel, to be worked in connection with the floating elevators now in use in Montreal harbor. By the use of this shovel it is claimed that grain can be trans-shipped in less than half the time it has taken heretofore.

Incorporation has been granted to the Smart-Eby Machine Co., Limited, of Hamilton, Ont., to carry on business as iron founders and manufacturers of engines, boilers, pumps and other machinery. Mr. W. C. G. Smart, one of the company, was recently associated with the Jenckes Machine Company.

A canal boat propelled by electricity has been invented by Mr. H. L. Welsh, of Cowansville, Que. It is claimed that the boat will do away with the necessity for locks. At a recent meeting of the Amalgamated Hudson Canal Association, it was decided to offer a prize for a practical canal boat propelled by electric power, and Mr. Welsh hopes to obtain the prize.

Mr. Frank A. Cote, of the firm of Cote & Courselles, electricians, Ottawa, has invented a new lightning arrester which he claims will greatly minimize interruptions of telephone service caused by wires coming in contact with those of stronger currents, and also prevent overheated wires from setting fire to buildings. Mr. Cote's invention was tested recently in the presence of experts of the Bell Telephone Co., and is said to have proved successful, the strongest currents being intercepted.

The record for long distance telegraphing is claimed to have been broken by the Associated Press on its regular system of wires leased from the Western Union Telegraph Company. A continuous circuit of six thousand miles, reaching from New York city to the Pacific coast, and from Chicago to New Orleans, was successfully worked for several hours. There were forty-one operators copying from a sender in New York, with 41 newspapers being served directly from this one circuit in thirty-eight of the leading cities of the United States.

The owners of the Wellington Extension Mine at Oyster Bay, B.C., have let a contract to Geo. C. Hinton & Co., of Vancouver, for a complete tramway and electric light system, the cost of which will be about $60,000. The electric tram lines will be about five miles in length, operated by two 150 h.p. generators, direct connected to two automatic high speed horizontal engines of same capacity. The contract also includes two standing mining locomotives of 100 tons capacity and the electric lighting of the entire mine. Messrs. Hinton & Co. will complete the contract this summer.

An English contemporary is responsible for the following: Everything industrial in Germany, as is well known, is carefully inspected and supervised by the authorities, but the education of these gentlemen is not always up to the average of that of their fellow-countrymen, as the following story shows. The other day a government official inspected an iron foundry, and remarked in his report to his superior that there was no incrustation in the boilers at the works. Upon which the superior, in evident disgust at what he considered a want of enterprise on the iron founder's part, at once issued the peremptory order: "The deficient incrustation of the boilers at this factory is to be remedied forthwith."

The West Kootenay Power & Light Co., of Rossland, B.C., have, in order to meet the demands for power, found it necessary to increase their generating plant at Bonnington Falls to double its present capacity. This company commenced furnishing power to its customers a little over one year ago, and to-day have their two 1,000 h.p. generators loaded to their fullest capacity. This speaks well for the management of the company, who deserve to be congratulated on the success of a venture such as they have undertaken in transmitting electric energy successfully over a distance of nearly 40 miles. They installed originally two 1,000 h.p. three-phase revolving field generators of the Canadian General Electric Company's type, and have recently placed an order with the same company for one 2,000 h.p. machine of the same type, together with marble panels, switchboard, etc. They have also ordered from the Canadian General Electric Co. 3,000 kilowatt capacity in high potential step-up and step-down transformers.

The city council of Winnipeg, Man., recently invited tenders for the installation of a system of arc lighting. The by-law having been carried by the ratepayers on April 6th, it is proposed to proceed at once with the installation of the plant. For the supply of two 100 light 2000 c.p. arc dynamos, a marble switchboard, and necessary instruments for double the number of circuits at present required, including station wiring, the tender of the Western Electric Co., of Chicago, at $5,320, has been accepted. This company will also supply 220 single carbon arc lamps for $4,532, and extra globes at $7.80 per dozen delivered. The Polson Iron Works Co., of Toronto, will furnish two compound cross condensing engines, at the price of $7,800. The tenderers for electric plant were: Western Electric Co., Chicago; Canadian General Electric Co., Toronto; Royal Electric Co., Montreal; and United Electric Co., Toronto. For engines the tenderers were: Polson Co., Toronto; Goldie & McCulloch Co., Galt; John Inglis & Sons, Toronto; and Robb Engineering Co., Amherst.

TRADE NOTES.

The Royal Electric Company are installing in the premises of the Hudsons Bay Company at Winnipeg a complete electric lighting plant.

The Montreal Island Belt Line Railway Company, of Montreal, have purchased four additional C.G.E. 1000 railway motors from the Canadian General Electric Company.

The Hamilton Brass Mfg. Company, of Hamilton, are installing in their factory, a 30 h.p. S.K.C. induction motor to drive their shafting. They are also being lit throughout by electricity.

The British Columbia Sugar Refining Company, of Vancouver, B. C., are increasing their lighting plant, and have purchased another 500 light multipolar dynamo from the Canadian General Electric Company.

The Cataract Power Company, of Hamilton, are installing in the premises of the Norton Mfg. Company, three 15 h.p. and one 20 h.p. S.K.C. induction motors to operate the entire factory by electricity.

The Canadian Pacific Railway Company have just placed an order with the Canadian General Electric Company for one 75 h.p. induction motor, and one 75 h.p. synchronous motor which are to be used at their smelter at Trail, B. C.

The Dowswell Mfg. Co., of Hamilton, Ont., are having installed in their works one 30 h.p. two-phase motor of the Royal Electric Company's make. The current for this installation is to be taken from the Cataract Power Company's service.

The B. Greening Wire Co., of Hamilton, Ont., had installed in their works about three months ago, a 40 h.p. S.K.C. two-phase motor by the Royal Electric Co. They receive their current from the Cataract Power Co. This has worked so satisfactorily that they have placed an additional order for one 50 h.p., one 30 h.p. and one 20 h.p. motors of the same type, to operate their entire works by electricity.

The ELECTRICAL NEWS acknowledges receipt of the annual report issued by the Engineering Society of the School of Practical Science, Toronto. Among the papers of interest to the electrical and steam engineering fraternity are the following: "Modern Systems of Interior Wiring," by L. B. Chubbuck; "Construction of the Cataract Power Company's Plant at Decew Falls," by W. Hemphill; "The High Pressure Steam Boiler," by E. Richards.

SPARKS.

Arrangements are being made for installing an electric plant for lighting the village of Columbia, B. C.

The Palmerston, Ont., Electric Light Co. has entered into a five years' contract with the town for street lighting.

The Parry Sound Copper Mining Co. propose to erect at Parry Sound a factory for the manufacture of copper wire.

The Almonte town council have asked the electric light company to sell their plant to the town. The company, it is said, ask $20,000.

Mr. R. A. L. Gray, of Toronto, is the successful tenderer for electric wiring of the Presbyterian church to be built at Oshawa, Ont.

The tender of the Electrical Construction Co., London, has been accepted for supplying an electric light plant for the Jubilee Hospital in that city. Two dynamos and two engines will be put in.

McColl Bros. will supply the engine oil for the Works Department of Toronto, at 40 cents per imperial gallon. The Royal Oil Co. will supply extra cylinder oil at 45 cents, and boiler purger at 35 cents.

The town of Galt, Ont., invites tenders up to May 10th for the installation of an arc and incandescent lighting system. Particulars may be obtained from Mr. J. H. Scott, Chairman Fire and Light Committee.

The City of Ottawa, Ont., invites tenders up to May 16th for furnishing water turbines and pumps for waterworks plant, to be so arranged, if preferred, that auxiliary electric motors may be attached at a latter date.

The city of Winnipeg, Man., have purchased four Babcock & Wilcox boilers for the proposed waterworks plant, at the price of $14,952. A contract has also been given to John Macdougall & Co., of Montreal, for a Worthington pumping engine, at the price of $89,080.

The Chicago Mica Co., through its president, Mr. Milton A. Snyder, has placed a trial order for mica with Blackburn Bros., of Perkins' Mills, near Ottawa. This company, which has a capital of $10,000,000, will probably invest extensively in the mica mines of the Ottawa vicinity.

The town of Barrie, Ont., through its consulting engineer, Mr. Roderick J. Parke, of Toronto, invites tenders up to May 17th for the supply of low speed 125 h.p. steam engine, two 125 h.p. steam boilers, two independent condensers, one duplex feed steam pump and necessary piping and connections.

A deal has recently been closed by the Shawinagin Water & Power Co., of Montreal, which will enable the company to proceed with the development of the water power at Shawinigan, near Three Rivers, Quebec. Reference to this proposed scheme was made in our March issue. The contract for the construction of canals, bulkheads, foundations for power houses, etc., has been given to the Warren-Scharff Company, at a price in the vicinity of $300,000.

A company, in which Canadian capitalists are interested, has been incorporated in New Jersey for the manufacture of automobiles under the patents of Mr. C. E. Woods. The company, known as the Woods Motor Vechicle Co., is capitalized at $10,000,000, and will establish two factories in Chicago. Mr. Frederick Nicholls, of the Canadian General Electric Co., is vice-president, and Mr. H. P. Dwight, president of the Great North Western Telegraph Co., one of the directors.

The Ogilvie Milling Co., of Winnipeg, Man., have invited tenders for furnishing a 1,200 h.p. engine for their mill.

Tenders are invited up to Thursday, June 15th, for lighting the town of Petrolia, Ont., by electricity. The present contract expires at the end of this year.

Mr. M. Martin has asked the town council of Wallaceburg, Ont., for an electric lighting franchise, but as yet his request has not been granted.

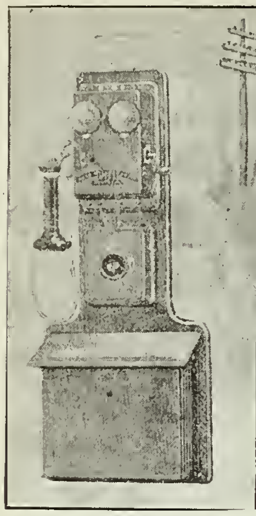
Telephone Girl—"You must never swear over the telephone, sir!"
Indignant Voice (at other end of wire)—"I'm not swearing over it. I'm swearing at it!"

Mr. B. F. Reesor, manager of the Lindsay Light, Heat & Power Co., states that his company is negotiating with the Peterboro Light and Power Co. for power to operate their plant in Lindsay.

Incorporation has been granted to the Standard Mica Co., of Toronto, Limited, with a capital of $90,000. The promoters are H. A. Clarke, Ewan Mackenzie, and E. W. Klotz, of Toronto, E. I. Sifton, of London, and Charles M. Clarke, of Cape Vincent.

The Ottawa Electric Light Co. have made an offer to the city to dispose of their plant business and good will to the corporation at par. The stock amounts to about $1,000,000. The company agree to hold this offer open for one year, on condition that no other lighting franchise is given during that time.

At the forthcoming exhibition in London, Eng., fourteen commercial efficiency tests of motor cars will be made. The distance will vary from twenty-five miles to seventy miles per day. The trials will be for vans carrying from 15 cwt. to three tons, and pleasure and other carriages carrynig from four to sixteen passengers, with prizes for the longest run without stopping for adjustment or fuel.



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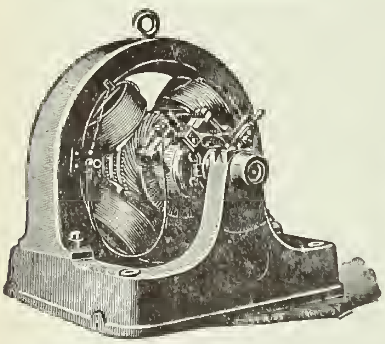

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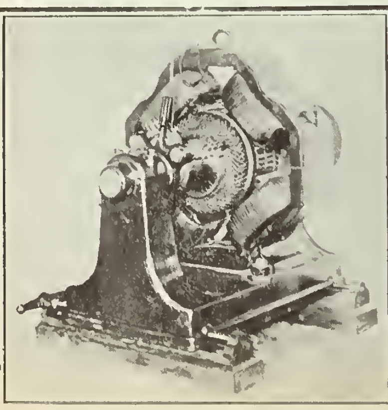

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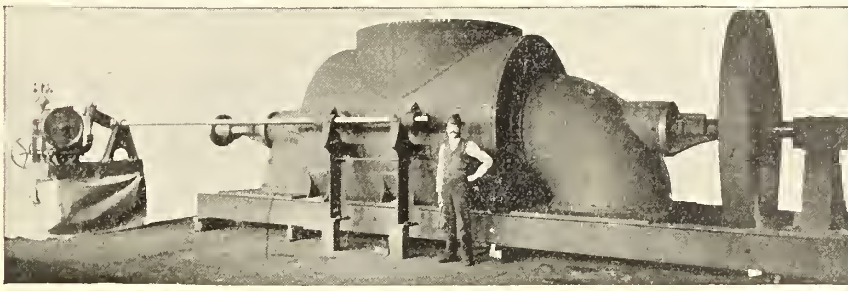

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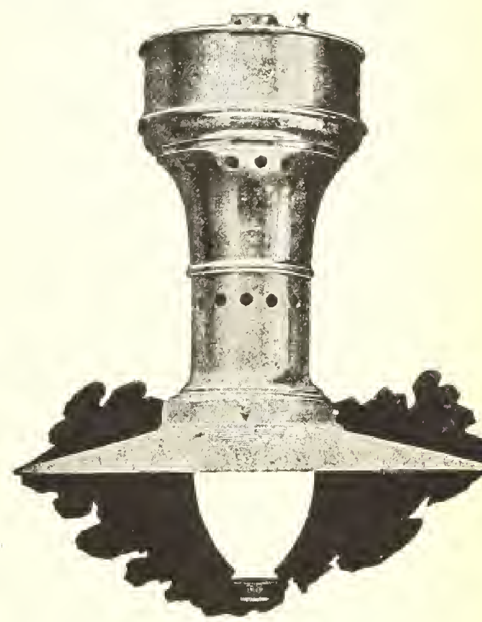

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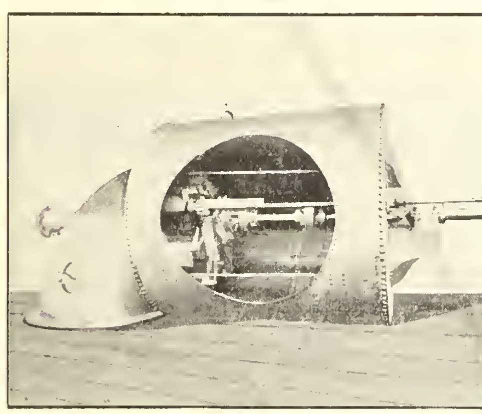

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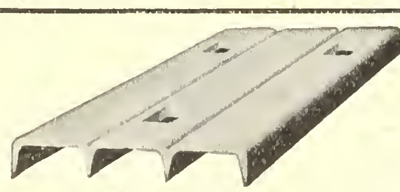

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WATER POWER DEVELOPMENT AT CHAMBLY.

By Charles W. Haas.

At the present time, when the development of desirable water powers and the electrical transmission and utilization of the energy thereby obtained is attracting such widespread consideration from both capitalists and manufacturers, the attention of the reader is directed to the original features and subsequent improvement of the power site at Chambly, P.Q., some eighteen miles from Montreal, on the Richelieu river. This stream, as is generally known, is the outlet of Lake Champlain. It has a strong current, and before the building of the big dam at Chambly its course near that point was broken up by a series of rapids. It was to the possibilities of development which were offered at this place that the attention of the Royal Electric Company of Montreal was directed early in 1893, when the rapid increase in their business made it apparent that more power would soon be demanded, and that unless other arrangements were made, an addition to their steam plant would be necessitated. After due consideration, therefore, they secured an option on this water power at Chambly, extending from Chambly Basin for about four miles up the river, and had preliminary plans and estimates made. These first plans contemplated developing 15,000 h.p. by building two dams and two power houses, each for 12-feet head, at a cost, exclusive of the electrical machinery, of about $80 per h.p. Vertical turbine wheels and gears and timber crib dams were proposed.

In the spring of 1894 A. C. Rice, of Dayton, Ohio, a hydraulic engineer of wide experience, was requested to examine the proposed water power and to prepare plans and estimates for its development. He observed that the question of anchor ice (frazil) was one that demanded serious consideration in designing a plant, where, as in this case, the development of uninterrupted power was contemplated. This was the more apparent because considerable trouble from this source had been experienced by the cotton mills on the Chambly side of the river, where water power to a limited extent had been utilized for some time. The records showed that the water in the Chambly Basin had been known to rise nearly 8 feet by reason of the accumulation of anchor ice flowing down the river. Engineer Rice concluded, however, that if the power house were properly located, and the power were developed under one head of 28 feet, there would be no anchor ice to interfere with the operation of the plant ; and he prepared his plans accordingly.

These plans called for one power house and one dam, the latter built of concrete ; and by the use of horizontal wheels and direct connected generators, it was proposed to develop, under the head of 28 feet before mentioned, a total of 20,000 h.p., or 5,000 h.p. more than the plans of 1893, at a cost of about $28 per h.p., exclusive of the electrical machinery. In order to satisfy themselves fully regarding the most practical plan to adopt, still a third engineer was called in, that his views of the feasability of developing the power under one head of 28 feet might be obtained. The preparation of his plans and estimates consumed nearly a year's time, and, when submitted, were found to fully endorse the idea of one dam and one power house, though they called for a timber crib dam filled with stone. It was estimated, however, that the cost of the timber crib dam therein suggested would bave been some $40,000 more than the concrete dam called for in the plans of Engineer Rice.

In the meantime the Chambly Manufacturing Company had been organized, the principal stockholders in it being the men who composed the Royal Electric Company. They took over the water power options which had been secured by the Royal Electric Company, and proceeded to carry out the projects of their predecessors. The plans of A. C. Rice were adopted, and in August, 1896, a contract was entered into with the Stilwell-Bierce & Smith-Vaile Company, of Dayton, Ohio, whereby they were to take the river and conditions just as they were at that time, develop the power demanded, and turn the whole plant over to the Chambly Manufacturing Company ready to run, except that they were not to furnish the electrical machinery required.

Oct. 1, 1896, work was begun on the cofferdams, and during that winter some 10,000 cubic yards of rock were excavated under the power house and in the tail race. The concrete work on the dam and power house was commenced May 1 of the following year, and on Oct. 28, 1897, upon the completion of this portion of the work, the waste gates were closed, and the water began flowing over the crest of the big dam, the length of which, including the waste gate walls, is nearly 1,900 feet. Unfortunately, at the time the water began flowing over the dam, some of the concrete was only two weeks old, and owing to the very low temperature of the water it set very slowly ; so that when the ice, some two feet in thickness, went out of the pond in the spring,

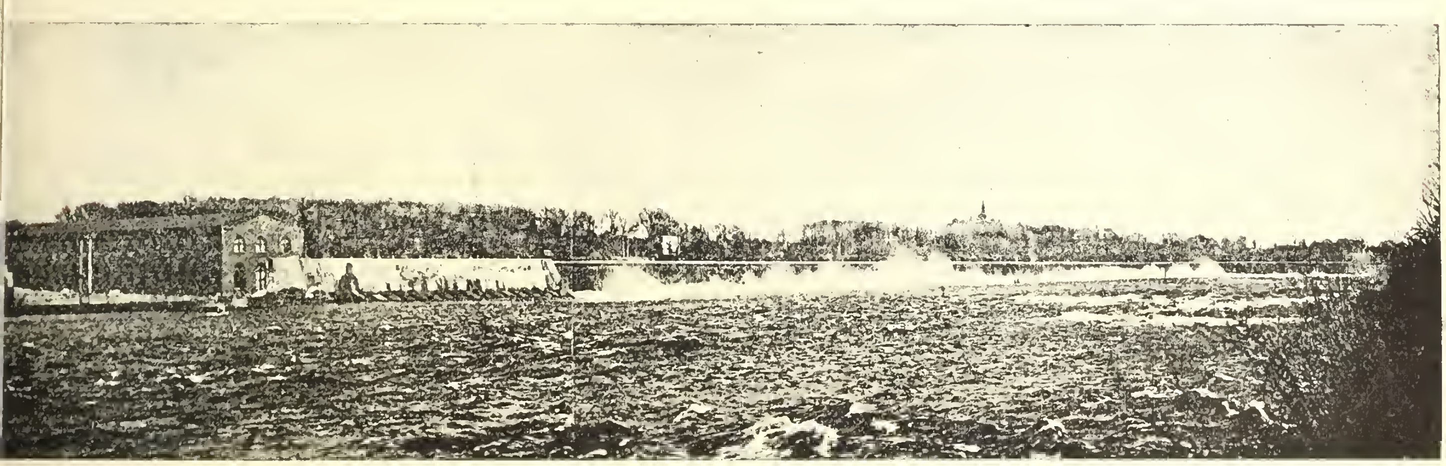


Fig. 1.—General View of the Chambly Power Plant.

it did some damage to the apron of the dam, repairs to which where made after the low water in the fall of 1898.

Having in mind the highest recorded rise in the Chambly Basin due to the accumulation of frazil, the engineer located the power house about 2,000 feet further up the river, and established the tail water level about four feet above the low water level in the basin, making the wheel pits deep enough and the draft tubes long enough so that if, as he anticipated, it was demonstrated that there would be no further trouble from anchor ice after the power was developed, the tail race could be excavated four feet deeper, thereby increasing the power about 2,800 h.p. without any change in the machinery.

The forebay and wheel chambers are built in ten sections, with walls 5 feet thick between the chambers. The wheel pits are built in seventeen sections, with walls 2 feet 6 inches thick to carry the generator floor and power house, and bringing one wall directly under the centre of each generator. Through the arches and over the wheel chambers there are manholes 6 feet in diameter directly over the centre of the wheels, so that any part supplying the cotton, woolen and grist mills of A. T. Willet & Son with power. On the rear side of the waste gate wall, around the gate openings, is a continuous southern pine timber frame, built into the wall flush with the face, to receive the gate frames. The waste gates and frames are cast iron and each gate is set on sixteen rolls, so that with the operating device on the top of the walls, two men can operate a gate under any condition of water in the river. On the top of this waste gate abutment wall is a pipe protection railing about 4 feet high, extending from the corner of the power house to the end of the abutment at the crest of the dam.

The specifications were carefully drawn up, and called for a high quality of work throughout. Some idea of the amount of labor involved may be gained from the statement that the engineer's estimates included, among other items, over 91,000 cubic yards of rock excavation, 33,763 cubic yards of concrete work, and something like 36 tons of half-inch round iron, this last-named material being built into the dam. All of the electrical work and machinery was furnished and installed by the Royal Electric Com-

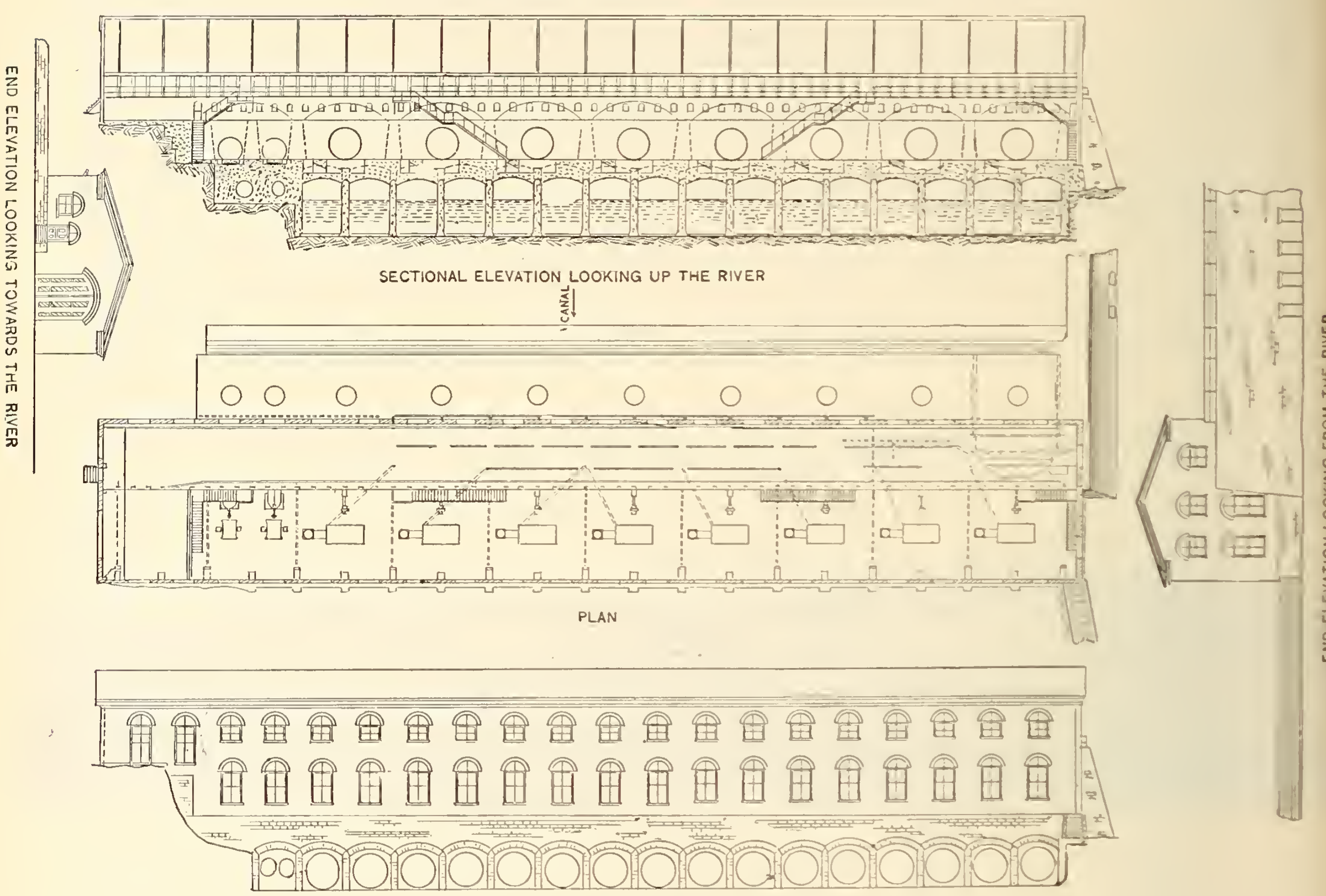


Fig. 2.—Plan and Elevation of Power House.

of the wheels can be removed from the outside of the generator room. The forebay, wheel pit walls and power house foundations are built of concrete; while the power house above the abutment and gallery floors is a steel and brick structure 75 feet wide, 308 feet long and 30 feet high from the floor to the chord of the roof trusses. The walls are 13 inches and 17 inches thick, with one course of brick outside of the steel structure. The inside of the power house walls is plastered with cement mortar, finished smooth and painted. Fig. 2 shows plan and elevations of the power house, and illustrates clearly the general arrangements.

Joining the river end of the power house and forebay walls is a waste gate abutment wall. This wall is 27 feet wide on the base, 8 feet wide at the top, and is about 33 feet high and 185 feet long. It is provided with 15 waste gates, each having an opening 4 by 6 feet.

The dam is 26 feet wide on the base, 6 feet wide at the crest, and is 18 feet high above the apron; while the total height varies from 20 to 28 feet, with the crest 4 feet below the abutment. The overflow dam extends up the river 1,151 feet, thence across the river 550 feet, where it joins the abutment on the Chambly side. This abutment has three feeder pipes 6 feet in diameter, for pany, of Montreal. The heavy machine work was done in their shops at Montreal, the lighter work and assembling being done at the power house at Richelieu. This made the progress of this portion of the work very slow and expensive; but, as the power was to be used in the city of Montreal, and the wire line had to cross the St. Lawrence river on the new Victoria bridge, it has been impossible to deliver power in the city until the completion of the bridge. Aside from this, the disrupted ownership of a certain strip of ground lying between the city limits and the abutment of the bridge would still have made it doubtful as to just when the current could be delivered at the sub-station in Montreal, even if the bridge were finished.

The exciter wheels were first started Nov. 18, 1897, and the first power from them was delivered to a saw and grist mill at Richelieu, situated about one mile from the power house, Jan. 27, 1898. The generator wheels were started Feb. 22, and the first generator was connected to the wheels May 26, 1898.

The wisdom of developing the power under one head of 28 feet, with the idea of obviating the trouble previously experienced with frazil, was fully demonstrated during the winters of 1897-98 and 1898-99, when the cotton mills ran continuously without any trouble whatever; while at the same time the exciter wheels were operat-

ing, and the waste gates were discharging more water than the large wheels will ever use.

Twelve inches of the outside face of all the walls and the dam itself is built of concrete composed of one part best Portland cement, two parts good clean sharp sand, and five parts of broken stone that would screen two inches, while the inside portion of the dam is built of large blocks of stone excavated from the tail race and filled solid with concrete.

The full turbine equipment will consist of 16 pairs of 46-inch cylinder gate horizontal wheels, and two single 27-inch cylinder gate horizontal wheels; all of the "Victor" type. The 48-inch wheels are used for driving the generators, each two pairs of turbines constituting one unit, which will develop 2,648 h.p. and 153 revolutions per minute under 28-foot working head. Each unit furnishes the motive power for one of the 2,500 h.p. generators, leaving in the wheels 148 h.p. for regulation. For each two pairs of these wheels there is provided a Giesler electrical governor mounted in front of the wheel chamber, with a suitable hand wheel located near the governor and generator for operating the gates. Fig. 3 shows sectional elevation through the wheels and power house.

The 27-inch wheels, each of which develops 200 h.p. and 260 revolutions per minute under 28-foot working head, are used to drive the exciting generators. Each of these exciting generators requires 175 h.p., leaving 25 h.p. in each wheel for regulation, which is provided by a Snow mechanical governor for each, mounted in front of the wheel chamber. Sectional elevations through the exciter wheels and power house are shown in Fig. 4. At the present time both the exciter wheels are in place, and eight pairs of the generator wheels. The power house, forebay and wheel chambers are, of course, arranged for the reception of the remaining eight pairs of generator wheels as soon as the Chambly Manufacturing Company may call for them.

Fig. 5 shows the exterior, and Fig. 6 the interior of the power house. It will be observed that it is light and roomy; the generators on one floor and the switchboards in the gallery above where the operator can have an unobstructed view of the whole generator room.

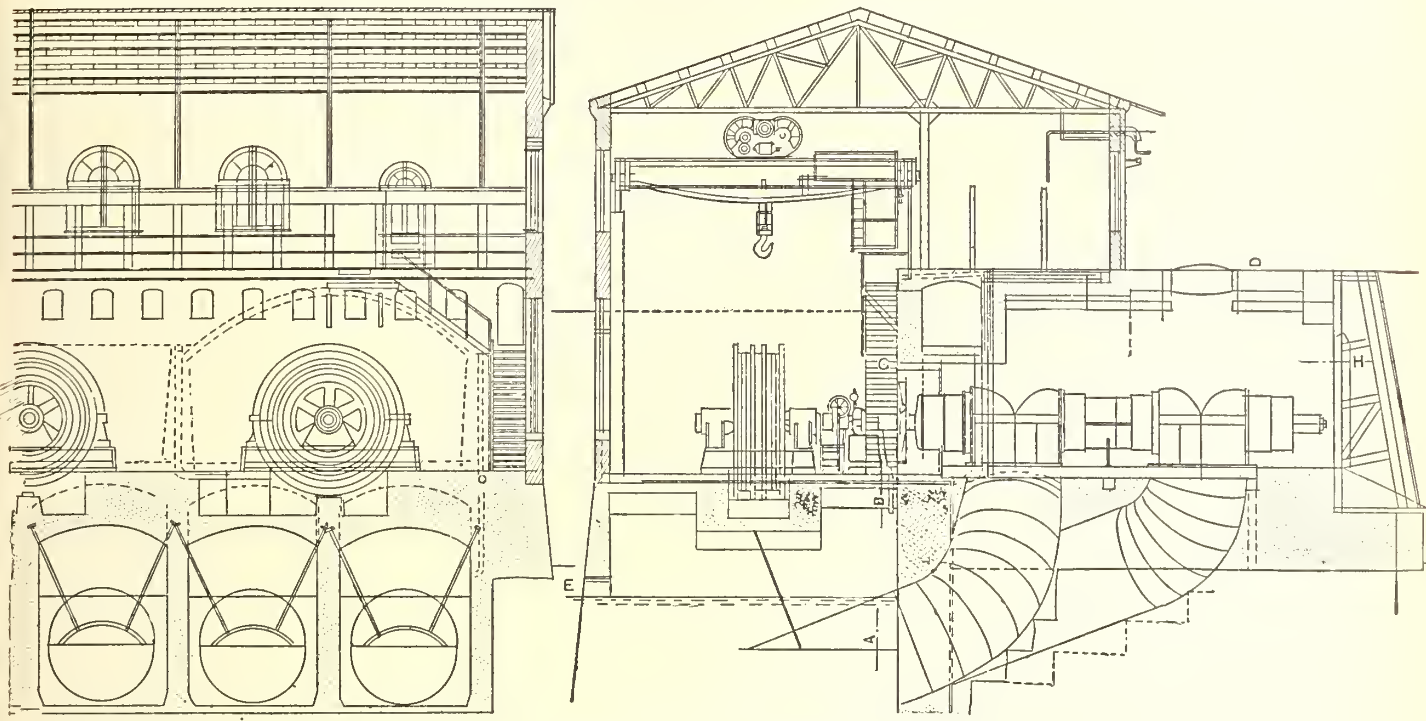


FIG. 3.—SECTIONAL ELEVATIONS THROUGH WHEELS ANE POWER HOUSE.

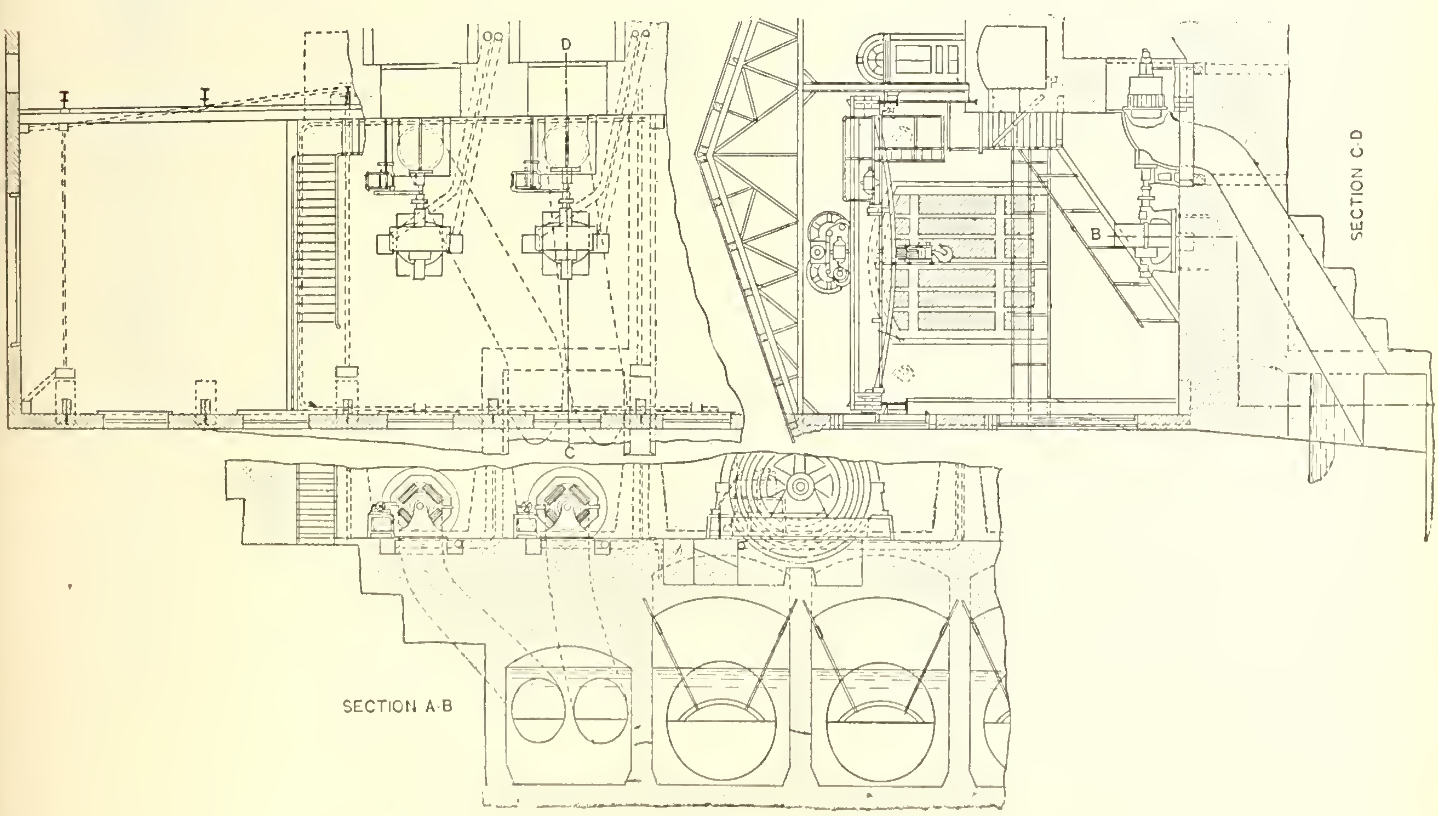


FIG. 4.—SECTIONAL ELEVATIONS THROUGH EXCITER WHEELS AND POWER HOUSE.

The entire plant affords an excellent example of modern engineering practice, and great credit is due both to the engineer and the builders of the powerful turbines and generators. Unusual interest has been manifested in the progress of the work by prominent engineers, and the plant has been visited by a number of the leading engineering societies.

The four sets of wheels and generators were started April 10

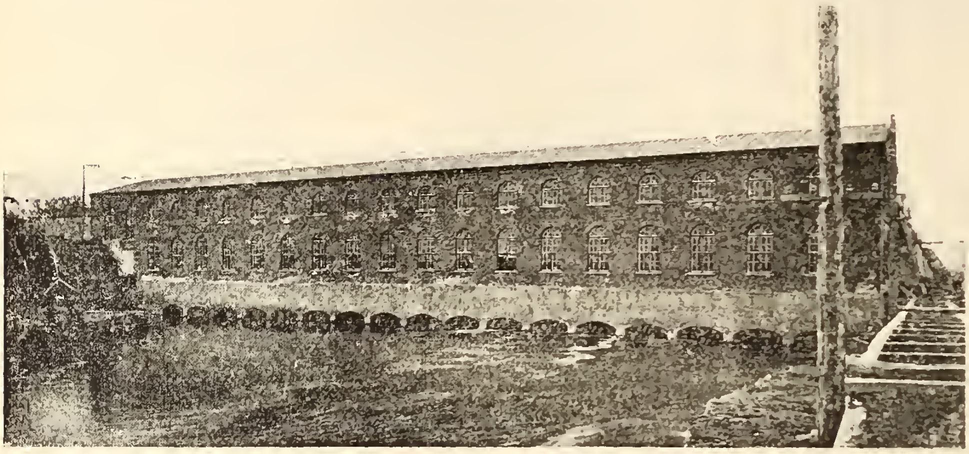


FIG. 5.—EXTERIOR OF POWER HOUSE.—CHAMBLY POWER PLANT.

for a continnous trial run of thirty days, as provided for in the contract between the Chambly Manufacturing Company and the contractors for the water-power equipment. The results have been very satisfactory indeed, and a rheostat test of the generators has shown as high at 3160 h.p. output of one generator with about a 30-foot head of water on the wheels. As soon as the wire line to Montreal can be completed, the abundant supply of electrical power available will prove of immense value to the industrial interests of the city, and will mark the beginning of an era of greatly improved conditions.

All the iron and steel work, including the waste gates, hand rail, rack frame and rack, wheels, draft tubes, steel structural work in building, traveling crane and crane track, was furnished by the Stillwell-Bierce & Smith-Vaile Co., who contracted, as before stated, for the entire hydraulic plant; but sub-let the work of excavation and building to Peter Lyall & Sons, of Montreal.—Electrical World.

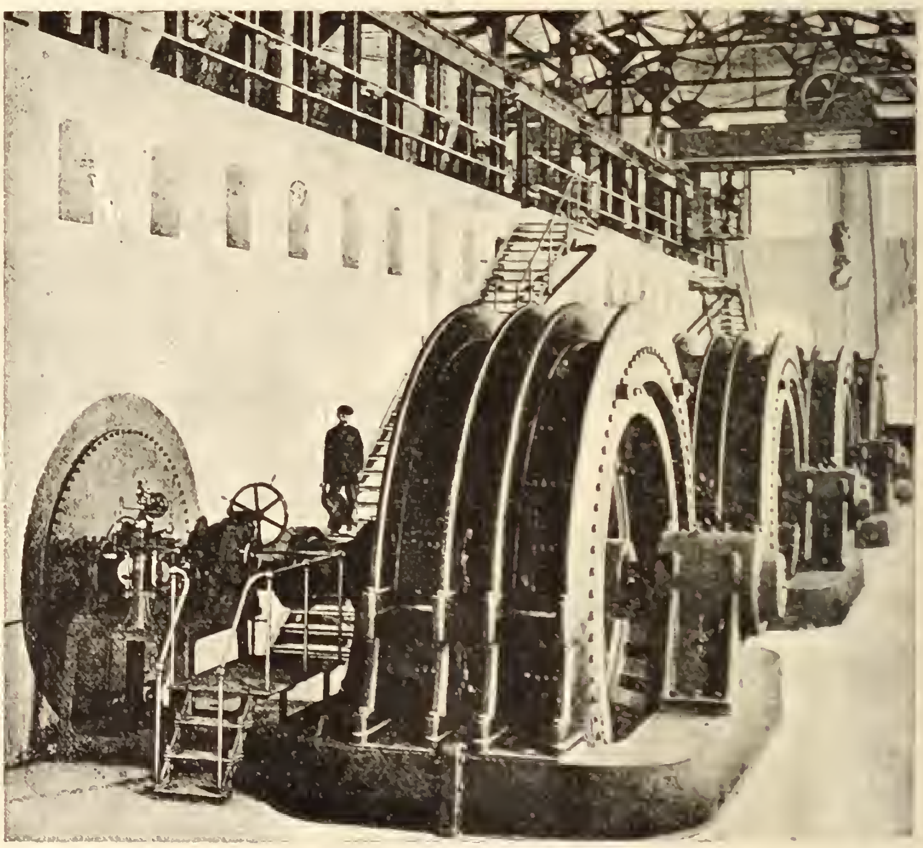


FIG. 6.—INTERIOR OF POWER HOUSE.—CHAMBLY POWER PLANT.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

Montreal No. 1, C. A. S. E., have decided to hold a picnic and games on Saturday, July 15th, at Cartierville. This picnic is being held for the purpose of assisting the mechanical library of the association.

James Aikins, secetary of Brockville No. 15, furnishes the following list of the officers of that branch: Past president, John Grundy; president, Wm. Robinson; vice-president, Chas. L. Bertrand; recording secretary, Jas. Aikens; treasurer, W. F. Chapman; conductor, Clarence Van-Arnum; doorkeeper, Victor Hannan; trustees, Edward Devine and James McRitchie.

The City Council of Toronto have awarded the contract for electrical apparatus to be used for lighting the new city and county buildings to the Canadian General Electric Company. The plant consists of one 100 kilowatt direct connected unit, together with switchboard and instruments.

PERSONAL.

Mr. Edward Bailey, electrician for the Perth Waterworks Co., has removed to Montreal, where he has obtained a more lucrative position.

In the recent bye-election in North Waterloo, Mr. L. J. Breithaupt, president of the Berlin Gas & Electric Company, was elected to a seat in the Ontario legislature, defeating his opponent by 116 votes.

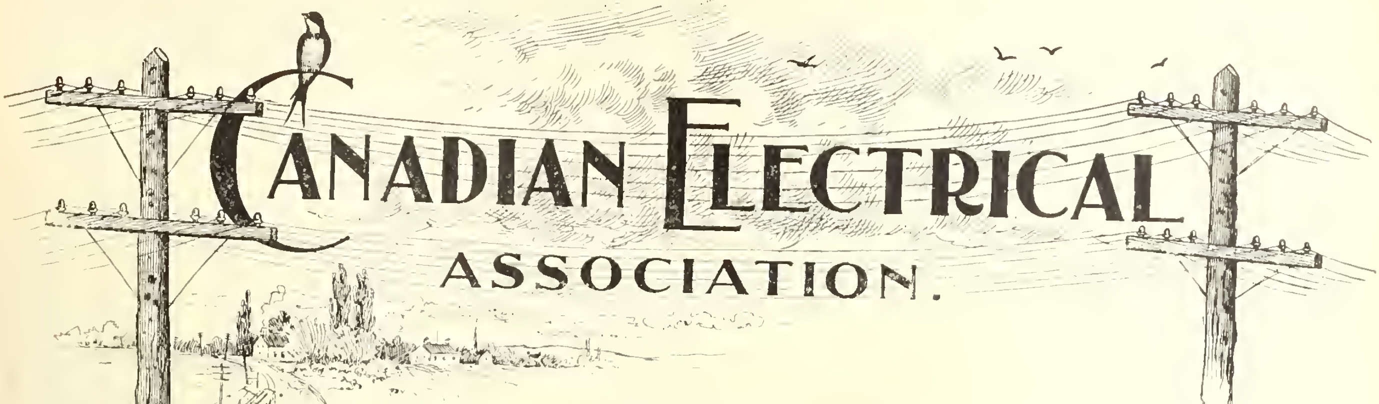
To Professor Dean Bovey, of the Faculty of Applied Science of McGill University, Montreal, belongs the distinguished honor of being elected a member of the Council of the Institute of Civil Engineers, of England.

The ELECTEICAL NEWS learns with regret that Mr. J. Wilson, superintendent of the C. P. R. telegraphs in British Columbia, has been confined to the hospital at Nelson through serious illness. He is now, we understand, almost recovered.

Mr. Nelson Graburn, assistant superintendent of the Montreal Street Railway, has resigned his position, and will shortly go to Glasgow, Scotland, where he will become superintendent of the Glasgow Corporation tramways. Mr. Graburn, while assistant to Mr. McDonald, had charge of the electrical equipment of the company.

Mr. Wm. W. Grant, of the engineering and sales department of the Westinghouse Electric & Manufacturing Company, has been transferred from the New York office of that company to the office of the Canadian agents of the company, Messrs. Ahearn & Soper, Ottawa. The Westinghouse Company's business in Canada is assuming large proportions.

Mr. J. Wm. Morris, a graduate of McGill University, Montreal, has gone to Kingston, Jamaica, having received the appointment of electrical superintendent of the street railway there. Since graduating Mr. Morris has held the position of superintendent of the St. John and Moncton, N. B., railway systems, and has occupied a responsible position with the Royal Electric Company, of Montreal.



CONVENTION PROGRAMME.

Convention Headquarters—New Royal Hotel,
Hamilton, Ont.

BUSINESS PROGRAMME.

Wednesday, June 28th.

11.00 A.M. Meeting of Executive Committee.

2.00 P.M. Opening of first session in Convention Hall, New New Royal Hotel.
President's Address.
Reading Minutes of Last Meeting.
Secretary-Treasurer's Report.
Reports of Committees and General Business.
Presentation of Papers.
Discussion.

Thursday, June 29th.

9.30 A.M. Consideration of Reports of Committees.
Election of Standing Committees.
Selection of Place and Time of next Meeting.
General Business.
Presentation of Papers.
Discussion.

2.30 P.M. Presentation of Papers.
Discussion.

Friday, June 30th.

9.30 A.M. Election of Officers.
Unfinished Business.

LIST OF PAPERS.

"Meters and Meter Rates." A. A. Dion, Ottawa.

"Cost of Electric Power Produced from a Steam Plant." C. B. Hunt, London, Ont.

"Inspection": Compulsory inspection of installations; Montreal Fire Commissioners' Report as to causes of fire. W. J. Plewes, Montreal

"Long Burning Enclosed Arc Lamps." W. A. Turbayne, Hamilton, Ont.

"The Incandescent Lamp for Central Stations," considering efficiency, candle power, distribution of light, regulation, and whether 220 to 240 volt lamps are likely to come into general use, also a reference to the Nernst lamp. E. E. Cary, St. Catharines, Ont.

"Central Station Accounting from a Business Standpoint." P. H. Hart, Montreal.

"Transformer Economy." F. H. Leonard, Jr., Montreal.

In addition to the papers, there will be a few matters for general discussion, also a "Question Box."

SOCIAL FEATURES.

Wednesday, June 28th.

7.30 P.M.—Trip to Burlington Beach and excursion on the Lake, returning by Hamilton Radial Railway, visiting en route the power stations of the Hamilton Street Railway Company and the Hamilton Radial Railway Company.

Thursday, June 29th.

5.00 P.M.—Trip to Grimsby over the Hamilton, Grimsby and Beamsville Electric Railway, and on return, visit to the Hamilton Electric Light & Power Company's power station

9.00 P.M.—Annual Association Banquet, New Royal Hotel.

Friday, June 30th.

12.30 P.M.—Take train on Grand Trunk Railway for visit of inspection to the Cataract Power Company's works at DeCew Falls; leaving for Hamilton and points east and west at 5.31 p.m.

ACCOMPANYING the programme of the forthcoming annual convention of the Canadian Electrical Association, printed above, will be found in succeeding pages, particulars and illustrations of some of the electrical and other features of interest in and about the city of Hamilton, where the event will take place.


Convention Headquarters—New Royal Hotel, Hamilton.

Some of our readers will recollect that the first convention of the Association, following soon after its organization, took place in Hamilton. The success then achieved was such that the promoters felt encouraged to go forward, and the subsequent history of the Association has been one of steady development. In the proceedings of the first convention held June 14th, 15th and 16th, 1892, are recorded the names of several gentlemen who are still members of the various committees of the Association, and are regarded as being among the most active and successful promoters of its welfare. There should be a reunion of all these at the coming meeting, in addition to an attendance of the majority of those whose membership dates from a later period. Not only so, but it may reasonably be expected that electric lighting companies throughout the province will mark their appreciation of the value of the Association's recent efforts to conserve the rights of the electric lighting industry, by submitting their names for membership at or previous to this meeting.

From an electrical point of view, especially, Hamilton has made wonderful progress since the time when the first convention of the Association met there. Ottawa and Montreal were then the only important electrical centers in Canada. Recent developments have placed in the same rank, Hamilton, Quebec and other cities.

The enterprise of the citizens of Hamilton in this di-

rection is seen in the numerous electric railway systems which now radiate from that centre. By the construction of these railways Hamilton has attracted to itself the trade of a large and prosperous territory, and has thereby greatly increased its commercial importance and prosperity. The Cataract Power Co. represents the greatest and boldest enterprise of the citizens of Hamilton in this direction. By successfully providing for the generation and transmission of at least 8,000 horse power of electrical energy, from a water power situated near St. Catharines, they have, so to speak, taken the wind out of the sails of the electric power companies at Niagara Falls, so far as the market for power between St. Catharines and Toronto is concerned. Having got their plant in successful operation, the question of finding a market for all the power which can be developed at their works is understood to be now engaging the attention of the management, and it need cause no surprise if before or shortly following the convention, the rumored consolidation under one management of all the electric light and railway companies having their headquarters in Hamilton, should become an accomplished fact. These electrical developments, combined with the numerous other features of interest set forth by the programme, together with the attractiveness of the city itself, and its central location and accessability by rail and water, should ensure for the coming convention a large attendance and a full measure of success.

The local committee having charge of the convention arrangements is as follows: Messrs. George Black, superintendent G. N. W. Telegraph Company, chairman; Mark Thomas, manager Hamilton and Dundas Railway; H. R. Leyden, manager Cataract Power Company; Gordon J. Henderson, manager Hamilton Electric Light & Power Company; A. J. Nelles, manager Hamilton, Grimsby & Beamsville Railway; Wilfred Phillips, manager Niagara Falls Park & River Railway; A. B. Smith, G.N.W. Telegraph Co.; E. E. Cary, manager Packard Electric Company; J. B. Griffith, manager Hamilton Street Railway; C. K. Green, manager Hamilton Radial Railway.

City Hall, Hamilton, Ont.

THE ELECTRIC RAILWAY SYSTEMS.

The Hamilton Street Railway was the first in Canada to be operated enitrely by electricity, the old horse car system being converted to electric power in the year 1892. This system, operating within the city limits, comprises 11 miles of double track. The equipment consists of 35 motor cars, built by Jones, of Troy, N. Y., and 15 trailers. The electrical equipment is Westinghouse excepting one equipment of G. E. 1,200, which is used on a water car for sprinkling the streets, this being done under special contract with the city. The road extends to Dundurn Park, owned by Senator McInnes, which is one of the finest in the Dominion, and also connects with two inclines, one at the head of James street and one at the head of Wentworth street. The power house of the Hamilton Street Railway Co. is a brick and stone structure situated at the foot of Hughson street, on the shore of Hamilton Bay. The motive power consists of wheelock tandem compound condensing engines, six boilers and Westinghouse dynamos. The officers of the company are as follows: President, Edward Martin, Q. C.; vice-president, John A. Bruce; secretary-treasurer and manager, J. B. Griffith; electrician, V. H. Waggoner.

Besides the Hamilton Street Railway, the city is fast becoming the centre of a magnificent system of radial railways. The longest road is the Hamilton, Grimsby and Beamsville electric railway, which travels east to Grimsby and Beamsville, a distance of 24 miles, passing through a country that for years has been known as the fruit garden of Canada. The power house, a brick and stone structure, is situated at Stoney Creek, about midway between the two terminals of the road. The generating plant consists of two Westinghouse dynamos, 300 h.p. capacity in engines, and two 200 h.p. in tubular boilers. The cars consist of nine motor cars and five trailers. Mr. A. J. Nelles is secretary and manager of the road, and Mr. C. Fraser chief electrician.

The Hamilton Radial electric railway leaves the city by the north-east, skirting the bay shore until the beach is reached, then crossing the beach and passing between handsome villa residences to the village of Burlington, ten miles from the city of Hamilton. Two C. G. E. generators of 400 k. w., 500 h.p. in engines, and 300 h.p. in boilers, comprise the equipment of the power house, which is located at Burlington. Six motor cars and two trailers are operated. Mr. C. K. Green is manager and Mr. C. G. French chief electrician.

In the year 1896 the Hamilton and Dundas railway, then operated by steam, was converted to an electric spstem. It extends from Hamilton to Dundas, about 5 miles to the west. Mr. Mark B. Thomas is manager

of the road and Mr. P. McCullough chief electrician.

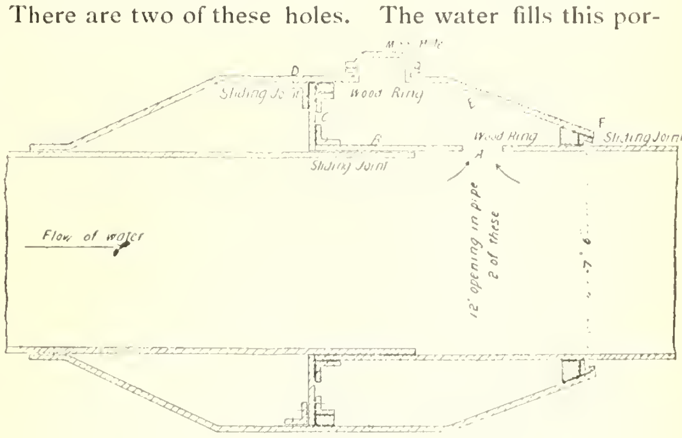
THE CATARACT POWER COMPANY.

The magnificent enterprise of the Cataract Power Company has already been described in the ELECTRICAL NEWS. Power is generated near St. Catharines, Ont., and transmitted, at a pressure of 24,000 volts, to the city of Hamilton, a distance of 35 miles. In a paper by Mr. Wm. Hemphill, read before the Engineering Science of the School of Practical Science, Toronto, we find the following additional particulars regarding the construction of the steel pipe that carries the water from the reservoir at the edge of the mountain to the wheels in the power house: The pipe is 735 feet long, 8 feet 6 inches in diameter at the top, and 7 feet 6 inches at the bottom; it is ¼-inch thick at the top and gradually increases to a thickness of 13-16-inch at the bottom, both tranverse and longitudinal seams being double riveted. This pipe is large enough to supply 6,000 h.p. At the top of the mountain, the stone was dug out to a depth of 8 or 10 feet, the pipe laid in this, and securely fastened by concrete in the mason work, heavy flanges having first been riveted to the pipe. The flanges were necessary as a great part of the weight of the pipe is supported at the top. At the upper end of the pipe, suitable grates are placed, to keep out ice and drift wood. As the current in the canal is very slow, there is not much danger arising from drift ice. At distances of 15 feet down the side of the mountain solid blocks of mason work are built for the pipe to rest on.

COURT HOUSE, HAMILTON, ONT.

About two-thirds of the way down the side there is a ledge on the mountain about 60 feet wide, the pipe follows this, and then runs down at an angle of 20° to the power house, where it turns almost at right angles, and passes under the power house. Near the edge of the ledge in the mountain there is an expansion joint, to take up any elongation or contraction that may occur in the pipe. This joint is constructed so that it supports the remainder of the weight of the pipe. The joint, being larger than the pipe, rests in a hollowed-out portion of the mason work, making it very secure.

The illustration shows a longitudinal cross-section of this expansion joint. At B is shown how two sections of the pipe slide, one inside the other, with a piston and cylinder action, forming a sliding joint. At C is shown an iron ring, fastened with angle iron as shown, and this forms a sliding joint at D. At A is a 12-inch opening in the pipe, through which the water can flow. There are two of these holes. The water fills this por-



CROSS-SECTION OF EXPANSION JOINT IN PIPE.—CATARACT POWER COMPANY.

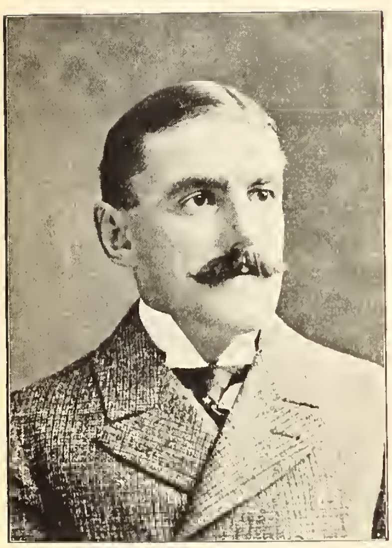
tion of the joint, and the pressure of the water against C has a tendency to keep the lower part of the pipe in place. The water presses against E, causing a little spring in the joint. The combined action of the spring in the iron and the pressure of the water against C takes up any elongation or contraction that may occur. It was found necessary to pack the joints with wooden rings, as shown, some six or seven inches thick, and when the wood swelled, it stopped the leakage to a large extent, but this swelling of the wood will not allow the joint to move much. As F is an iron ring around the pipe, this ring is flanged and riveted to part E, as shown, forming another sliding joint.

THE HAMILTON ELECTRIC LIGHT & POWER COMPANY.

Situated on Main street is the dynamo room of the Hamilton Electric Light & Power Co., its dimensions being 135 x 70 feet. The machines consist of arc and incandescent lighters and electric power generators. There are two Royal alternators with exciters, one C.G.E. 2,000 lighter, and one Westinghouse 1,800 lighter. Fifteen machines of varying power are for the supply of arc lights, fourteen being from the Royal Electric Co. There are two pair of Brown engines of 700 h.p. each. On King street is a three-storey structure in front, combining the offices of the company and several other offices. The rear is taken up by the boiler room, where there are three batteries, one consisting of five 60-inch Osborne-Killey tubulars of 75 h.p. each, the second of two 66-inch Goldie & McCulloch tubulars of 90 h.p. each, and the third of two Polson water tubulars of 200 h.p. each. This company now hold the contract for lighting the streets of Hamil-

Mr. E. E. Cary.

Mr. Mark B. Thomas.



Mr. H. R. Leyden.

Mr. Geo. Black, Chairman.

Mr. A. B. Smith.

Mr. C. K. Green.

Mr. A. J. Nelles.

Mr. Gordon J. Henderson.

SOME MEMBERS OF THE LOCAL COMMITTEE—CANADIAN ELECTRICAL ASSOCIATION CONVENTION, HAMILTON, 1899.

ton. Recently the management decided to take power from the Cataract Power Co.'s system, instead of generating it themselves. Mr. Gordon J. Henderson is manager of the Hamilton Electric Light & Power Co., and Mr. T. W. Martin chief electrician.

G. N. W. TELEGRAPH OFFICE.

About 2 o'clock a. m. on the morning of May 19th, 1898, during a severe thunderstorm and downpour of rain, the office of the Great North-Western Telegraph Company in Hamilton, along with the building in which it was situated, was destroyed by fire. So complete was the destruction that not an instrument or even a printed message blank was saved out of the wreck—the books (the current month's business), a portion of the lower office furniture, and some battery cells only being rescued. As early as possible the chief operator and the linemen cut all the wires through, so that by the time of opening for business at 8 a.m. all through circuits were completed, and no stoppage of business except with Hamilton ensued. The only wires incommoded temporarily were those depending upon Hamilton batteries, which were demolished in the basement of the burnt building. The manager in the meantime had secured the only vacant premises in the neighborhood, and at 7 a.m. began moving in the few articles saved

Post Office, Hamilton, Ont.

The new location was about 60 yards south of the old office, and as no poles could be erected, a 50 wire cable was secured for temporary use ; instrument tables, battery stands, etc., had to be made out of pine boards. The first supplies arrived from Toronto by the 8 o'clock train, wires were rapidly got working, and before dark all necessary circuits were connected with the office. Those not required for local purposes were left cut through in the cable box ; about one hundred wires were in the mix, but few offices were aware that anything unusual had occurred. The temporary quarters being too small, the adjoining office with No. 34 was secured and fitted up for permanent quarters. The premises are 18 by 61 feet, all on the ground floor; front consists of a large plate glass window, and door on each side. The counter running across the office is made of ash, with cherry top, covered with plate glass, a neat brass screen dividing it lengthways, with openings to receive messages through. Inside are the necessary desks, etc., for clerk and manager, and below these desks is the operating department. The switch case and instrument tables are of ash and cherry. The tables provide space for 21 instruments, three sets of repeaters, and space for extension. The switch is Bunnell's latest design, with space for 70 wires. The office presents a neat and handsome appearance, windows at back and front giving perfect light and ventilation, metallic ceiling of neat pattern and light color, walls covered with grey ingrain paper, with 18 feet ceiling.

The wires are led into the office in two 50 wire and one 18 wire Kerite cables, boxed in, and back of switch case opens into a distributing box. This box and its surroundings are covered with asbestos board, and every precaution possible has been taken to avoid fire from electric contacts after leaving the box each wire passes through covered porcelain fuse blocks, which are separated from each other by glass strips, then recabled to the switch-board, and from the switch-board cabled to each instrument table. All wires not in cables are Kerite covered. The sounders are in resonator boxes of neat design, and everything arranged for prompt and efficient handling of business with perfect ease.

The office is admired by all who have seen it. One gentleman connected with the telegraph service who has visited all the principal offices in the United States and Canada, says it is one of the neatest he has came across.

Although the old office took fire during a thunderstorm, there is nothing to connect the fire with lightning coming in on the wires. All reliable evidence indicates that the fire started in the south part of the building, and rapidly spread to the north end. The telegraph operating room floor was not touched, and the business office damaged by water and fire entering from behind. The office is under the management of Mr. George Black. Members of the Canadian Electrical Association are invited to visit the office during their stay in Hamilton.

THE BELL TELEPHONE EXCHANGE.

The Hamilton exchange of the Bell Telephone Company is quite important, inasmuch as it is the central distributing point for long distance messages to the United States and elsewhere. The exchange is under the management of Mr. B. J. Throop, while Mr. H. C. Baker, manager for Ontario, also makes his headquarters in Hamilton. The company intend to lay a

number of underground conduits in the city this summer.

HAMILTON AND BARTON INCLINE RAILWAY.

It is well known that along the south side of the city of Hamilton, and extending for miles in either direction, stretches a bold, steep escarpment, known as the Hamilton mountain. This mountain is from two hundred to four hundred feet higher than the level of the city, and to provide means of access for wagons, electric cars, etc., the Hamilton and Barton incline railway, a view of which is here shown, was constructed in the year 1892. It is a straight cable road of uniform grade, extending from a point at the commencement of the rapidly rising ground to the top of the escarpment. The distance between these two points is 700 feet, and the rise 195 feet. The central portion of the track is at an elevation of about 50 feet above the surface of the ground.

The road has a double track. The lower portion of the road-bed is built upon the ground, partly through a cutting and partly upon an embankment formed by the material taken from the cut. The road-bed at the lower end commences in a pit 13 feet deep—that is, 13 feet below the level of the approach to the track. This pit is formed to receive the peculiar-shaped cars of the road, which are built with level platforms and consequently, to suit the steep grade, which is 30.7 per cent., require to be 13 feet high at the one end, the other being as close to the track as possible.

The cutting within a very short distance attains a depth of thirty feet, the width of road-bed being 34 feet. The upper end of the embankment is terminated by a heavy stone abutment, built to receive the lower ends of four girders forming part of a steel trestle viaduct. This abutment is built with large, heavy stone, and provided with wing walls turning back to meet the retaining walls, or rather the retaining walls are extensions of the wings.

The steel trestle extends over about two-thirds of the length of the railway, and consists of eleven 30-feet spans and one of 37 feet. Most of the bents, which are of steel, supported by two stone piers or pedestals, are from 30 to 50 feet in height. They carry four parallel track girders two feet in depth and spread eight feet from centre to centre. The whole structure is designed so that a moving load of 60,000 pounds will not produce a greater strain than 10,000 pounds per square inch of section on any member. Across each pair of these inclined girders the ties are placed, and upon them, directly over the centre of the girders, the track rails, which are bolted to the girders. There are then two parallel tracks eight feet from centre to centre of rails and eight feet apart. Upon the bank, below the trestle, the tracks are laid in the ordinary way, except that the ties are supported on the lower side by stout stakes to prevent them from working down hill.

THE HAMILTON AND BARTON INCLINE RAILWAY.

On either track runs a car 36 feet in length by 14 feet in breadth. The cars are constructed with level platforms, being supported by wedge-shaped frameworks, which raise the platforms towards the lower end about 13 feet above the tracks. The cars are combination affairs, being arranged to carry passengers and teams at the same time.

Attached to two heavy timbers, braced by heavy iron knees, in the lower framework of each car, are two steel wire cables, each having a tensile strength of 125,000 pounds by actual test. From the car the

cables are carried up the centre of the tracks on small carrier wheels 14 inches in diameter.

At the head of the plane the cables pass over large cast iron sheave wheels 10 feet in diameter, these being strongly supported by iron girders and columns. Thence the draught cable passes down to a winding drum 10 feet in diameter, about 30 feet below, situated in the basement of the depot at the head of the plane; but the safety cable passes from the sheave wheels onto another large cast iron wheel of about equal size, which is set in a heavy iron framework and securely anchored to the solid rock, so that in case of the possibility of an accident happening to the draught cable the cars would be held securely by the safety. Powerful brakes are atttached to either side of the drum and to the safety wheel, and these may be applied by the engineer from the pilot house. The foundations of the drum, which itself weighs about 10 tons, are strongly anchored down to the solid rock by 16 two-inch iron bolts. The drum is controlled, and from it the road operated, by a pair of Wheelock engines of about 125 indicated horse-power.

The depot, situated at the head of the plane, and which contains all the machinery, is a four-storey stone and brick building. The basement is occupied by the engines and drum, the boilers and fuel room, and also contains a large room to be used as a workshop. The second and third flats are designed to be used as a dwelling for the engineer and his family, and the upper flat, which is only on a level with the top of the hill, contains the driving platform, a waiting room, a board room, and a large covered balcony looking out over the city. In the centre of the driving platform and opposite the centre of the tracks is situated the little 4 × 8 feet pilot house. This is built with large glass windows on all sides and commands a view of the whole road. Within it stands the engineer, who has within arm's reach the means of controlling every part of the machinery.

At the lower end of the plane there is another small but neat brick depot, and dwelling above it for a caretaker. The entrance to this depot is guarded by sliding gates, which are opened when a car is down. Into the face of the car pit are built four large iron air buffers—two for each car to strike against. These consist simply of 18-inch iron cylinders provided with pistons which are drawn out by wire sash-cords hung with weights and working over pulleys.

FEATURES OF INTEREST.

The Hamilton water works is owned by the city, the pumping station and filtering basins being at the Beach.

There are nine city parks in Hamilton, containing in all 52 acres. A view of the Gore Park will be found on another page.

Three fire stations are located in the central portion of the city, and four others in the outlying districts. Alarms are sent through a system of electric boxes, and also through the Gamewell police call system.

Anthority has been given the Hamilton Electric Light and Power Co., by the city council, to illuminate with incandescent lamps during the C. E. A. convention the Court House and Post-office buildings as well as the central park known as the Gore.

Royal Canadian Yacht Club, Hamilton.

Places of interest in and around Hamilton include the following: Burlington Beach, Gore, City Hall, Gore Park, Post Office, Court House, Ontario Normal School and Collegiate Institute, City Hospital, and Royal Canadian Yacht Club, an illustration of which appears elsewhere.

Hamilton possesses two hundred and twenty-seven manufacturing establishments, equipped with modern machinery and the latest labor-saving devices, and many of them, including the extensive works of the Gurney-Tilden Company, operated electrically by motors supplied by current by the Cataract Power Company.

The Hamilton Light and Power Company have had made of galvanized iron letters two feet in height the name of the company. A number of incandescent lamps inserted in sockets in holes in each letter will illuminate the sign and enable every passer by to read it. This sign will be put in position and illuminated during the Canadian Electrical Association convention, and on special occasions afterwards.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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The Demand for Electrical Machinery in South Africa.

SOME of the American electrical journals have lately referred to the fact that that during the last fiscal year $50,000 worth of electrical machinery from the United States was sold in Cape Town. Some American manufacturing firms have established resident representatives there, by which means they are regularly kept informed regarding trade demands. The suggestion is now made that the National Association of Manufacturers should establish in Cape Town a warehouse for the display of American goods, as has already been done at Caracas, South America. These pointers as to the doings of our American neighbors should be suggestive and useful to Canadian manufacturers.

Standardizing Direct-Connected Generating Machinery.

AT the recent meeting in Washington, D.C., of the American Society of Mechanical Engineers, Mr. J. B. Stanwood, of Cincinnati, presented a paper on "Standards for Direct-Connected Generating Sets." The author defined as the features that need standardization: A series of capacities and speeds, for the use of the outside engineer, and those parts of the engine and generator which have to be connected or fastened together to be standardized for each different set, to facilitate the assembling of the combined machine or "set." As the result of this paper and the discussion thereupon, a committee of the Society was appointed to co-operate with a committee from the American Institute of Electrical Engineers to consider the subject and formulate a method of standardization.

Dangers of Calcium Carbide.

PREPARATIONS have been made to establish two factories for the manufacture of calcium carbide within the limits of the city of Ottawa. This has elicited a protest from the Canadian Fire Underwriters' Association, on the ground that such manufactures should be classed with those of explosives, and therefore prohibited, except in isolated and remote buildings. In a letter to the City Clerk, Mr. Hadrill, Secretary to the Underwriters' Association, points out that the English government has taken action in this direction, owing to the hazard from the finished article. Supposing that the manufactured carbide be not stored on the premises, a large amount of it must necessarily be on hand, as the pigs of carbide take many hours to cool. Regarding the contention that water thrown upon carbide when hot will not generate gas but throw the water off in steam, Mr. Hadrill argues that the surface of the carbide pigs would soon become cooled, and gas generated which water would be powerless to extinguish; in fact, the more water poured on the worse would be the fire.

New Field For Central Stations.

It seems reasonably certain that in the near future the automobile carriage industry will become established on a commercial basis. Of the various kinds of motive power for these carriages, electricity gives promise of being most generally adopted. This almost certain increase in the number of electrical vehicles is likely to result beneficially to the central stations, the charging of the batteries providing a market for current during the day when there is usually a light load on the machines. In the larger cities, where a number of such vehicles would be used, an approximately constant day load could be carried. This question has already re-

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The first "S.K.C." Generator built in Canada was put in service
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THE ALLISTON ELECTRIC LIGHT CO., Alliston, Ont.	60 K. W.
C. O'DELL ELECTRIC CO., Annapolis, N.S.	60
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BERLIN GAS CO., Berlin, Ont.	60
BRANTFORD ELECTRIC & OPERATING CO., Brantford, Ont.	180
COCKSHUTT PLOW CO., Brantford, Ont.	20
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BRIDGEWATER POWER CO., Bridgewater, N.S.	40
G. H. DAVIDSON, Brighton, Ont.	30
CORPORATION OF CAMPBELLTON, Campbellton, N.B.	60
THE ELECTRIC CO., Chicoutimi, Que.	40
" " " " "	40
DUNDAS ELECTRIC CO., Dundas, Ont.	60
EDMONTON ELECTRIC LIGHT & POWER CO., Edmonton, N.W.T.	75
H. E. POULIN, Farnham, Que.	30
HAMILTON & PROUT, Forest, Ont.	30
CORPORATION OF FORT WILLIAM, Fort William, Ont.	60
" " " " " " "	180
GLEN WILLIAMS ELECTRIC LIGHT CO., Glen Williams, Ont.	30
JOHN PHILIP, Grand Valley, Ont.	20
" " "	75
GRAVENHURST ELECTRIC LIGHT & POWER CO., Gravenhurst, Ont.	50
CATARACT POWER CO., Hamilton, Ont.	1000
" " " " "	1000
HAMILTON ELECTRIC LIGHT & POWER CO., Hamilton, Ont.	300
" " " " "	240
" " " " "	240
LAKE & BAILEY, Hamilton, Ont.	50
CORPORATION OF JOLIETTE, Joliette, Que.	120
CORPORATION OF BARRIE, Barrie, Ont.	150
KOOTENAY ELECTRIC CO., Kalso, B. C.	75
J. T. AYERS, Lachute, Que.	120
CORPORATION OF MARKHAM, Markham, Ont.	20
CORPORATION OF MONCTON, Moncton, N. B.	60
DOMINION COTTON MILLS CO., Montreal, Que.	180
THE ROYAL ELECTRIC CO., Montreal, Que.	300
" " " "	300
" " " "	300
" " " "	300
" " " "	300
" " " "	180
" " " "	180
" " " "	135
" " " "	80
MONTREAL WATER & POWER CO., Montreal, Que.	300
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PENMAN MFG. CO., Paris, Ont.	30	"
CANADIAN ELECTRIC & WATER POWER CO., Perth, Ont.	180	"
" " " " "	56	"
PETERBOROUGH LIGHT & POWER CO., Peterborough, Ont.	180	"
THE MONTMORENCY ELECTRIC POWER CO., Quebec, Que.	600	"
" " " " "	600	"
" " " " "	600	"
" " " " "	600	"
" " " " "	600	"
" " " "	600	"
" " " "	240	"
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CHAMBLY MFG. Co., Richelieu, Que.	2000	"
" "	2000	"
" "	2000	"
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" "	2000	"
" "	2000	"
" "	2000	"
A. RIENDAW, Richelieu, Que.	75	"
RICHMOND COUNTY ELECTRIC CO, Richmond, Que.	60	"
" " "	60	"
W. McMASTER, Ridgetown, Ont	60	"
IRON MASK GOLD MINING CO., Rossland, B.C.	75	"
WELLAND VALE MFG. CO., St. Catharines, Ont.	25	"
ST. JEROME POWER & ELECTRIC CO., St. Jerome, Que.	75	"
CANADIAN COLORED COTTON MILLS CO., St. Stephen, N. B.	30	"
SHERBROOKE GAS & WATER CO., Sherbrooke, Que.	240	"
" " "	240	"
" " "	180	"
S. GEORGE, Stouffville, Ont.	20	"
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SYDNEY GAS & ELECTRIC CO., Sydney, C. B.	60	"
" " "	40	"
TEESWATER LIGHT & POWER CO., Teeswater, Ont.	20	"
NORTH SHORE POWER CO., Three Rivers, Que.	240	"
" " "	240	"
TORONTO ELECTRIC LIGHT CO., Toronto, Ont.	60	"
" " "	180	"
VANKLEEK HILL ELECTRIC CO., Vankleek, Ont.	50	"
A. GAGNON & CO., Victoriaville, Que.	75	"
WINDSOR ELECTRIC LIGHT CO., Windsor, N. S.	50	"
" " " "	90	"
RIORDAN PAPER MILLS CO., Hawkesbury, Ont.	30	"

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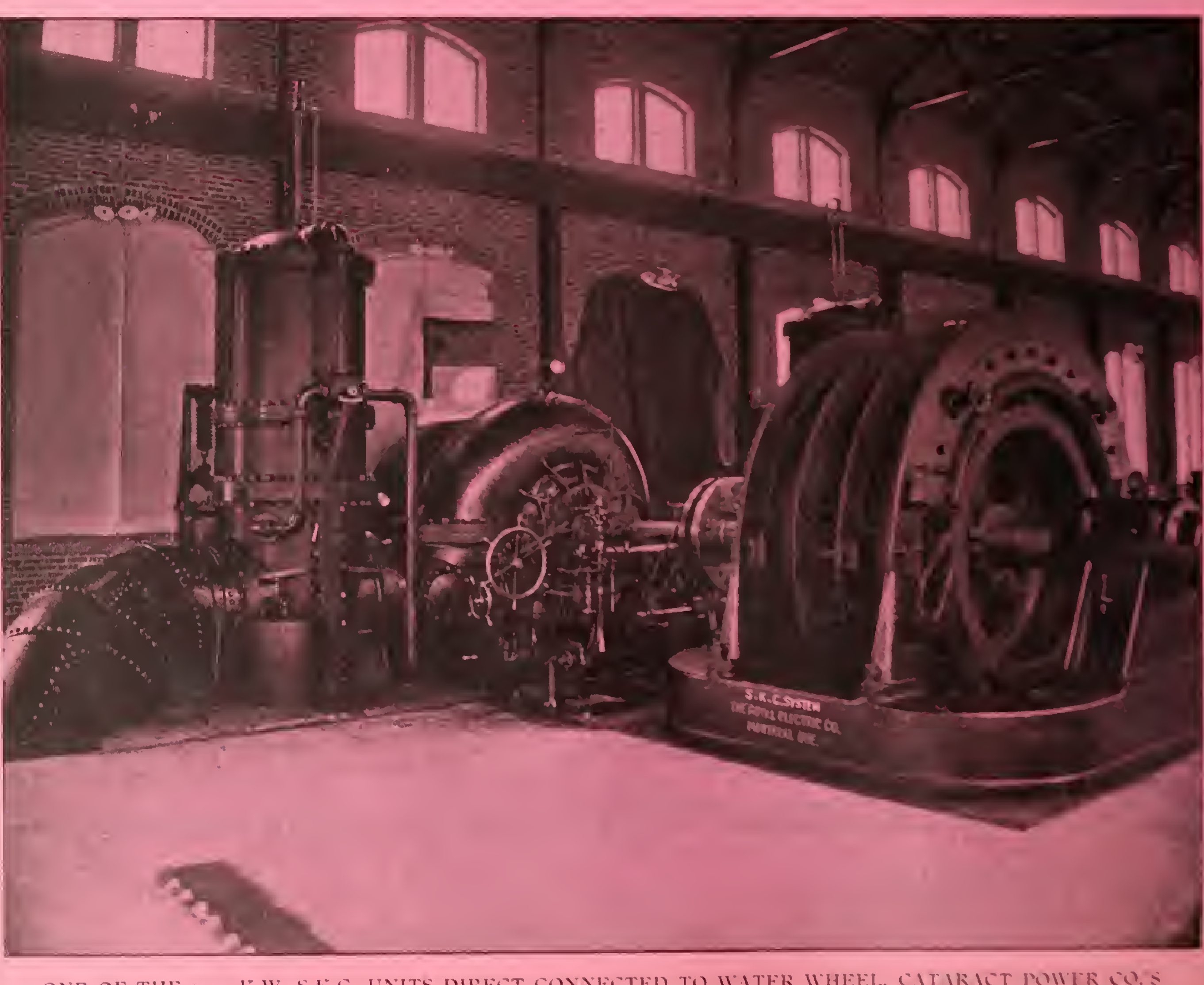


ONE OF THE 1000 K.W. S.K.C. UNITS DIRECT CONNECTED TO WATER WHEEL, CATARACT POWER CO.'S PLANT, NEAR ST. CATHARINES.

ceived some attentiou in the United States, a paper on the subject having recently been presented before the Northwestern Electrical Association by Mr. H. M. Maxim, who sees in the advent of the electric carriage a great advantage to the central station. While automobiles have as yet been introduced only in one or two Canadian cities, it is quite probable that they will become more generally used in the near future, although to what extent is uncertain. The large amount of asphalt and other smooth pavements now being constructed in our cities should encourage the use of electric carriages, as the best storage battery must become impaired by constant jolting over rough roads.

The National Electric Light Association. The annual convention of tne National Electric Light Association of the United States, held in New York last month, is declared to have been the most largely attended and in many other respects the most successful in the history of that organization. The president in opening the convention gave some statistics showing the wonderful development of the electrical industry within the boundaries of Greater New York. He said : " Within its limits are located thirty-five electric light stations, which furnish more than 1,000,000 incandescent lights, more than 30,000 arc lights, and at least 30,000 h.p. in electric motors. The capital invested for carrying on this great business is nearly $100,000,000. It may interest you to know that in 1897, in the City of Brooklyn alone, there were ten street railway companies having 678 miles of track, and a capitalization of $55,000,000. In that year these railway companies carried 223,180,504 people. To-day, every transit company in the borough of Brooklyn is equipped or about to be equipped with electricity as its motive power, and the capitalization is $150,000,000, and 236,680,010 people were carried by this vast system in 1898. Electricity, together with the inventive genius of honored members of this association, has made this wonderful change possible." A number of excellent papers were presented and discussed. A lecture on liquified air by Mr. Chas. E. Trepler, whose recent experiments have become so widely known ; an automobile excursion to Grant's Tomb ; and a visit to the General Electric Company's works at Schnectedy, were prominent and highly appreciated features of the occasion. General S. T. Carnes, of Memphis, Tenn., was chosen as president of the association for the ensuing year. It is probable that the next convention will take place in New York or Chicago.

Methods of Generating and Supplying Electricity. It would appear as though changes are likely to occur in some localities at least in methods of supply of electricity for light and power. In all the provinces of the Dominion, with perhaps the exception of Nova Scotia, New Brunswick and Prince Edward Island, steam users are obliged to import coal from Pennsylvania. In consequence of this fact, their fuel bill becomes one of the most serious items of operating expense. Owners and operators of works for the supply of electricity doubtless realize to the fullest extent the truth of this statement. There is no more important question to them than that of how to keep down the fuel account. The keenness of competition and other causes have in many instances reduced prices for current to unprofitable figures. In the majority of cases any attempt to increase them would probably not be successful, but, on the contrary, would be certain to lead to a disturbance of conditions which have come to be regarded, by the consumer at least, as being permanent, and would in consequence arouse antagonism to the companies. The latter must therefore adopt the alternative plan of trying to lessen, to the greatest extent possible, the cost of generating the current, while at the same time, by the use of the most improved apparatus and the best arrangement of circuits, ensuring the profitable utilization of as high a percentage of the current generated as may be possible. Naturally enough, under such conditions, the attempt is being made to cheapen production by substituting water power for steam wherever by this means a saving can be effected. The relative efficiency and economy of the two methods is one of the live and much discussed questions of the day. Without entering into the pros and cons of the subject, it may be said that weighty arguments can be advanced in favor of both systems—also that the relative economy of steam and water power is largely dependent on locality and circumstances. The latest phase of this subject is now in process of development, and is the result of the demonstration at Hamilton, Montreal, Quebec and elsewhere in Canada of the possibility of transmitting current at least over distances of ten to thirty-five miles, and supplying consumers en route and at the terminals at lower prices than could be offered by companies using steam to generate current on the spot. From this quarter has already come threatened competition to central station companies operating by steam in proximity to water powers, and it remains to be seen to what extent the present central stations situated within thirty-five miles of large water powers may find it most profitable to resolve themselves into distributing stations, receiving their supply of current at wholesale rates from an outside source.

Y.M.C.A. ELECTRICAL SOCIETY.

The summer course of the above society, organized by the electrical students in connection with the educational department of the Y.M.C.A., Montreal, opened on May 25th, when Mr. F. B. Horn delivered a lecture entitled "The Theory of the Telephone." The members have prepared quite an interesting syllabus for the summer months, the main feature being a series of lectures by practical men. The second one will be by Mr. J. C. Bray, of Messrs. Ness, McLaren & Bate, entitled "The Telephone in Practice." It is proposed to visit large electrical plants on the first and third Saturday of each month. Following are the officers : Honorary president, Prof. Herdt, McGill College ; president, Mr. F. B. Horn ; vice-president, Mr. R. B. Macdonald ; secretary and treasurer, J. C. Bray, 419 St. James street.

The following gentlemen connected with the electrical industry of Canada attended the recent annual convention of the National Electric Light Association held in New York : Mr. Fred. Nicholls, general manager of the Canadian General Electric Co. (ex-president of the N.E.L.A.) ; Mr. W. H. Browne, general manager of the Royal Electric Co., Montreal ; Mr. C. B. Hunt, manager London Electric Co., London, Ont.

Every person interested in electrical development—past, present or future—in Canada, is invited to participate in the Annual Convention of the Canadian Electrical Association at Hamilton on the last three days of this month.

TELEGRAPH and TELEPHONE

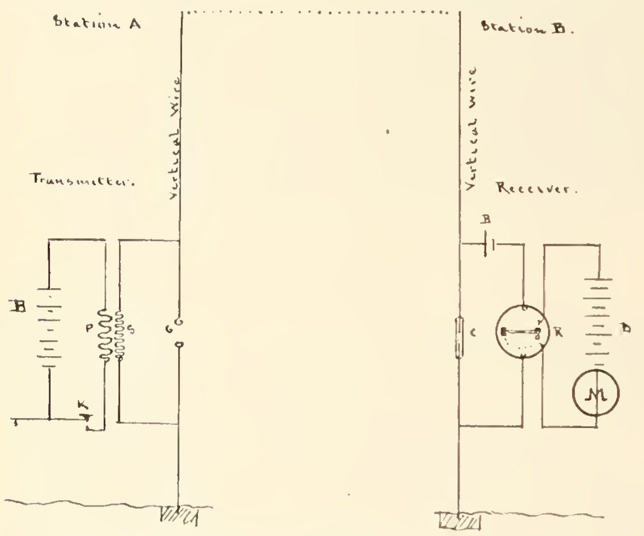
WIRELESS TELEGRAPHY.*

By F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E.

Recent shipping disasters which have occurred, more especially on or near the Atlantic seaboard of Nova Scotia, render the consideration as to the best means to be employed with the object of minimizing such casualities particularly appropriate at the present moment, in view of the fact of marine insurance rates having been raised on vessels bound to and from Canadian ports.

That the subject is one of no inconsiderable importance, as far as Halifax is concerned, will be at once apparent to those whose interests are connected with the maritime enterprises of this city, and as these interests concern, to a very great extent, the whole province, the presentation of the following remarks will need no apology on the part of the writer.

The enumeration of the many accidents to shipping on and near these shores, which have been chronicled during the past twelve months, would here be superfluous. The mere mention of such losses of life and property as those involved in the Burgoyne-Cromartyshire collision, the wreck of the Moravia on Sable Island, and the loss of the Castilian, will suffice as instances. In studying the subject of marine signals, and particularly those placed near the coast for the purpose of guiding the mariner into



B represents an electric battery. K, telegraph key.
P S, primary and secondary of induction coil.
G, spark gap between metal spheres.
C, coherer. R, relay. M, Morse sounder.

The dotted lines indicate the invisible Hertzian waves, produced by the oscillatory discharges from the induction coil when the key K is depressed. The waves are intercepted by the vertical conductor at station B and conveyed to the coherer. The relay circuit is brought into action, in the manner already described, and the local battery and sounder M complete the cycle.

port and warning him in respect to outlying dangers, the writer has recognized the advantage afforded by audible as opposed to visual signals. A system of electric buoys, to be placed at some distance from this harbour, was suggested in sundry communications, published in Halifax papers in 1891, and the general features of the proposed apparatus were fully described. Attention was again called to this subject in a paper read before the Maritime Electrical Association in September last. The proposal was regarded with favor by competent authorities, but as its practical application necessitated some considerable outlay, no encouragement was given to the scheme. But the advent of what is popularly known as "wireless telegraphy" renders the discussion of my proposed system of electric gong buoys, as far as the immediate object of this communication is concerned, for the present at least, unnecessary. The marvellous results now attained by means of the Marconi system of wireless telegraphy are so much in advance of those afforded by any other means that the question of improving the approaches to our coast and to our harbor is a comparatively simple one. The history of the various attempts to telegraph through space without the aid of intervening wires dates back, as far as the United Kingdom is concerned, to the early forties, but it is beyond the scope and objects of this paper to record the labors and achievements of those who have devoted their time and talents in the endeavor to perfect this long dreamt of project.

*Paper read before the Council of the Board of Trade, Halifax, N. S., May 16th, 1899.

The natural and practical question is how and by what means is this astonishing annihilation of space now rendered possible. In an admirable work on this subject, Richard Kerr, F. G. S., says: "The great fact to be apprehended in connection, not only with the several systems of telegraphy without wires, but with many other departments of science, may be expressed in the following words: Throughout all the solid materials of the earth, through all the liquids and gases, through ourselves and our atmosphere, through the moon itself, through all the vast distance of ninety-three millions of miles between us and the sun, in fact, throughout all things too small to be seen by the power of the best miscroscope ever constructed, and through all the space ever reached by the largest telescope in the world, there exists a medium known as the Ether. In fact, all interstellar space across which light travels, whether from our sun or from any other star, is filled with this ether. It is through this mysterious medium that light travels. If a stone is thrown into the middle of a pond, a series of ripples or small waves cover the surface of the water

Similar waves are produced in the air whenever a bell is struck, and the ether has its waves also. The ether conveys energy from the sun in the form of waves. These waves vary in length. To one set we give the name of light, and the eye is adapted to the appreciation of these waves. The surface of the body feels the other waves and to these we give the name of heat. Other waves are detected by delicate instruments and to these we give the name of electricity and magnetism. As the eye receives the light, so Lord Kelvin says, the delicate coherer of branly is an electric eye, in that it is sensitive to electric waves. In wireless telegraphy, as in other systems, the use of two pieces of apparatus, the transmitter and the receiver, are necessary.

The Marconi transmitter, by means of which oscillatory vibrations are produced, consists of the following apparatus: A battery, or source of electrical energy, an induction or intensity coil, with terminal brass knobs at the extremities of the secondary coil, and an ordinary telegraph key. The knobs are so adjusted, relatively to one another, that the electricity induced in the secondary coil by the charging of the primary, will bridge the space (the spark-gap) between the knobs, and a succession of oscillatory discharges will take place, and give rise to waves, which travel in all directions. The receiving apparatus consists of the following instruments: The coherer or "electric eye," as Lord Kelvin describes it, a sensative telegraph relay, and an ordinary Morse sounder or writer. The coherer is a sealed glass tube, about two inches long, with wires leading out from each end, in the inner extremities nearly meeting in the middle of the tube, but with a space or gap between them, in which is placed a small the quantity of metal filings. In their normal condition these filings do not perfectly complete the metallic circuit formed by the outer ends of the wires, leading from the extremities of the tube, and the relay to which they are connected. But when electric waves caused by the oscillitory vibrations of the distant transmitter reach the coherer the small particles of filings immediately cling together or cohere, thus completing the circuit of the relay, bringing into action a small battery, when the armature of the relay closes the local circuit and the sounder or Morse writer responds to the signals.

A small tapper, in the local circuit, is caused to agitate the tube and decohere the metal filings, so that they resume their normal position. A vertical wire at each station is an important part of the equipment that in connection with the transmitter imparts to the ether the vibrations set up at the sending station, and that at the receiving station intercepts the waves and conveys them to the coherer. This is by no means a full description of the appliances used, but it may serve to convey a general idea of the method employed to impart vibrations into space and to intercept them at a distant point. But it will be at once apparent that under some circumstances the radiation of signals in every direction would be an objectionable feature, not because a telegram so sent might become common property, but on account of interference or cross-signaling.

It is a perfectly easy and simple matter to read the messages now passing on an ordinary telegraph line, without disconnecting or even touching the wires, but no one ever takes the trouble to endeavor to become acquainted with other people's business by such means, and besides, all telegrams requiring secrecy are coded.

Nevertheless, there are conditions in connection with which the screening of the signals, either by the interposition of some non-absorbing substance, or the focussing of the radiations by means of projectors, or the syntonizing of the instruments, so that they

will respond only to certain vibrations, would appear necessary, and it is extremely interesting to learn that this phase of the problem has been dealt with successfully.

Not that the idea would be here given that finality in this respect has been reached, for much remains to be done in perfecting details in connection with this all important feature, but it is encouraging to read the statement that a development of more than ordinary interest in this regard has been recently announced, viz: that cross-signalling has been eliminated, and that arrangements have been successfully introduced whereby interference has been prevented between three stations which heretofore interrupted or interfered with one another.

So many wild rumors are published by enthusiastic and imaginative persons with regard to the future adaptation of wireless telegraphy, that a word from the lips of Signor Marconi may be of interest in respect to such startling announcements as those lately advanced, to the effect that the next experiment would be between the South Foreland and Paris. In the London Electrician of April 28th, Signor Marconi is reported as stating "that he knew nothing of such an experiment or of any serious attempt being made to establish wireless telegraphy between Ireland and New York."

He expressed his conviction that real progress was only to be made by shorter stages, and that he was determined to undertake no share in any experiment likely to bring the Marconi system into disrepute, through complete, or even partial failure.

He is fully in agreement with Dr. Flemming's view that wireless telegraphy is quite unlikely to take the place of wire telegraphy for long distance commercial work, but for connecting islands or places separated by sea, the system is now available up to distances of 60 or 70 miles.

If the Canadian government contemplates expending $120,000 for a telegraph cable to Sable Island, it is a question whether it would not be wise to consider how far that sum might be advantageously applied in providing the lighthouses on the island and on our coast with the Marconi apparatus, for whilst it is not possible at present to span the distance between Whitehead and Sable Island by means of wireless telegraphy, the establishment of a station on the island would render communication therewith at all times possible to a vessel provided with the necessary instruments, and as the use of such instruments will probably be general in the near future the actual need of a cable to the island will be less imperative than it has been in the past.

Wireless telegraph stations on such headlands as Cape Race, St. Pierre, Miquelon, St. Paul's Island and other lighthouse stations up the Gulf, Louisburg, Whitehead, Egg Island and Sambro, could probably be established at considerable less cost than would be required for a cable to the graveyard of the North Atlantic, indeed it might with reason be argued that one of the best means of averting such disasters as those which have occurred on that dangerous sand bank would be to adopt the suggestion now outlined.

It is gratifying to learn that the Wireless Telegraph and Signal Company, of London, intend giving a practical demonstration of the Marconi system of signalling on this side of the Atlantic, about August next, and it is hoped that Halifax will be one of the places selected for the purpose. The question of providing a steamer for the pilot service for the port of Halifax is one that has been mooted from time to time, and like every other proposed measure for the improvement of the approaches to our harhor, deserves careful consideration.

If Sambro were provided with a Marconi apparatus and the pilot steamer were likewise so fitted, the efficiency of the pilot service would be considerably augmented, for many potent and obvious reasons. With the lighthouses mentioned, and those of Little Hope, Roseway and Seal Island, radiating their signals to a distance of twelve to fifteen miles in the offing, no well equipped vessel need meet the fate of those which have left their bones along these shores and in the deadly sands of Sable Island.

SHORT-CIRCUITS.

The Bell Telephone Co. are laying a number of underground conduits in the city of London, Ont.

The city of Brantford, Ont., has granted the Bell Telephone Co. an exclusive franchise for five years, for the consideration of $450 per annum.

The St. Martins Telephone Co., of St. Martins, N.B., recently held its annual meeting and re-elected directors and officers. They are: John McLeod, M.P.P., president; W. H. Allen, vice-president; A. W. Mackin, secretary-treasurer and manager; C. M. Bostwick, W. E. Skillen and C. D. Trudnen, additional directors.

The Carman Telephone Exchange Co., of Carman, Man., is applying for incorporation. The applicants include J. E. Campbell and F. D. Stewart.

E. W. Crane, of Brantford, has issued a writ against the city and the Bell Telephone Co. for $5,000 damages. While working as a lineman, he came in contact with a wire which was not properly insulated, receiving injuries for which he claims damages.

It is stated that the Dominion government intends to complete the telegraph service between Quebec and Belle Isle within the next two years. The line has already been built to a point 160 miles below Quebec, and an additional 200 miles will be strung this year.

A charter has been issued to the Victoria Telephone Co., to operate in the town of Lindsay and throughout the county of Victoria, with head office at Woodville, Ont. The directors are J. G. Eyres and C. E. Weeks, Woodville; Arch. Campbell, Lindsay; J. J. Cave, Beaverton; W. H. Johnston, Pefferlaw.

Mr. Timothy Howard, telegraph engineer of the Australian post and telegraph department at Melbourne, Australia, is making a tour of inspection of the telegraph and telephone systems and other electrical developments in the principal countries of the world. He started from Melbourne last January, coming direct to San Francisco. He is travelling eastward and expects to get back home about Christmas time. He has visited the principal cities in the United States and Canada, and will stop at the principal centres in England and Europe. Mr. Howard sailed for England a few weeks ago.

Mr. T. A. Smith, district saperintendent of the Bell Telephone Company at Kingston, has invented special instruments of unique design for communication between the attendants on the surface and the divers at the bottom of the river, while they are engaged in the work of raising the Cornwall bridge. The ordinary diving apparatus has been dispensed with, and supplemented by special diving bells, so constructed as to withstand the pressure of the current. They are also protected by heavy metal shields. The telephone is put inside the bell, and electric alarms give the signal when either party desires to converse. Anybody can operate the ingenius mechanism.

MOONLIGHT SCHEDULE FOR JUNE.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 7.50	A.M. 1.20	5.30
2....	" 7.50	" 1.50	6.00
3....	" 7.50	" 2.20	6.30
4....	" 7.50	" 2.50	7.00
5....	" 7.50	" 3.20	7.30
6....	" 7.50	" 3.30	7.40
7....	" 7.50	" 3.30	7.40
8....	" 7.50	" 3.30	7.40
9....	" 7.50	" 3.30	7.40
10....	" 7.50	" 3.30	7.40
11....	" 8.50	" 3.30	6.40
12....	" 9.30	" 3.30	6.00
13....	" 9.50	" 3.30	5.40
14....	" 10.20	" 3.30	5.10
15....	" 10.40	" 3.30	4.50
16....	" 11.00	" 3.30	4.30
17....	" 11.00	" 3.30	4.30
18....	" 11.30	" 3.30	4.00
19....	....	" 3.30	3.30
20....	A.M. 12.00	.....	
21....	No Light.	No Light.	.....
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	No Light.	No Light.	.....
25....	P.M. 8.00	P.M. 10.30	2.30
26....	" 8.00	" 11.00	3.00
27....	" 8.00	" 11.20	3.20
28....	" 8.00	" 11.50	3.50
29....	" 8.00	A.M. 12.20	4.20
30....	" 8.00	" 12.50	4.50
....	... .	....	....
		Total.........	137.30

Without the least reflecting upon Montreal, Ottawa, Toronto or Niagara Falls, it can be stated that the Committee in charge of the local arrangements for the entertainment of those who may attend the C. E. A. Convention at Hamilton, will prove themselves to be past masters in the art of hospitality.

CHARGING CARRIAGE BATTERIES.

ELECTRIC carriages are coming into general use in the cities and towns where there are electric power stations, from the wires of which the storage batteries of such electric carriages can be readily charged. Some other method of charging such batteries is greatly needed. Could a simple and practical method of charging such batteries be used anywhere it would enable residents of country districts to use electric carriages. The writer has devised two methods. The first method consists in the use of an endless tread power to drive the motor of the electric carriage as a dynamo to charge the storage battery on the electric carriage while the latter is stationary and at or near the home of the user, or wherever such a tread power can be used. If the owner of the electric carriage has no horse to operate the tread power, either a donkey, a mule, an ox or a cow can be pressed into service to operate the tread power and drive the motor of the carriage as a dynamo to charge the storage battery on the electric carriage. In rural districts where engines are not available the tread power could also be used to thresh, clean grain, saw wood, cut straw, hay and roots, pump and churn without the intervention of the carriage motor used as a dynamo, and without the intervention of the storage battery.

The farmer could make one of his horses charge the storage battery in the manner outlined, and he could still keep the horse at home to do necessary work on the farm while the members of his family might drive a dozen miles and return by means of the electric energy which might be stored by the exertion of the horse, mule, donkey, ox or cow during the previous evening. Of course, absolutely no harness whatever would be required by the horse, donkey, mule, ox or cow while driving the endless tread power. No time need be spent in grooming the animal, and he need not be shod. A fractious animal might store his energy in the storage battery, and no runaways need be feared by the user of the electric carriage. When the carriage is not needed at night the electric energy stored in the carriage battery by the work of the animal at any time during the day might supply light for the house at night by means of incandescent electric lamps. Should it be preferred, the animal may operate the motor of the carriage as a dynamo at night, and so illuminate the house during the night without the intervention of the storage battery. But if the carriage is to be used at night a storage battery for the purpose of illumination may be installed in the house.

It is well known that the endless tread power is the best contrivance for utilizing the energy of animals. The animal while at work simply walks up an incline plane made of a belt of heavy slats which passes under him as he walks, and turns a wheel connected with the motor used as a dynamo by simple belting. The economy of the endless tread power is due to several causes. In the first place, the animal has to carry no load of harness; in the second place, he always walks on a good road, and in the third place he may walk at a uniform rate of motion.

Really, in the present age it seems absurd when a person wishes to drive a dozen miles away in order to remain a day or two, to hitch a huge beast, loaded with harness, to the carriage, and to use him but a small fraction of the time while absent from home. A horse is used to draw the carriage even though often not more than one-quarter of a horse power is really needed for the work. The horse while absent from home must be unharnessed, fed, watered, groomed and provided with a stable; all this causes considerable trouble, anxiety and annoyance. The horse, while drawing the carriage, may shy and run away because of rustling paper or other trivial cause, and endanger the lives of the occupants of the carriage. The roughest and most unsightly and ungovernable beast may store his energy in the carraige battery in the method outlined.

The user of the electric carriage, when on the road, may drive the same at either a high or a low speed; there is no danger of runaways; on arriving at his destination the electric carriage requires neither food, water nor care. He may let the vehicle stand still out of the way until it is again required for use.

The second method consists in using either small kerosene or gasoline engines, in the rural districts, to drive the motor of the electric carriage as a dynamo to charge the battery. Such engines are now sold at low prices and they are very economical in the use of fuel. In some cases steam engines already in use for other work may be used to charge the battery. These engines may also work the carriage motor as a dynamo to store electric energy for lighting houses, and they may also be used in threshing, cleaning grain, cutting feed, sawing wood, pumping and churning.

It will now be thoroughly understood that nothing need now prevent the extensive use of electric vehicles of every description, either in the country districts or in small villages and towns where there are no electric power stations. The country roads may soon be everywhere traversed by horseless carriages. The advantage of cleanliness, speed and convenience of such electric carriages are very great indeed.

The principle novelty in the methods outlined in this article consists in the use of the carriage motor as a dynamo for charging the storage battery of the electric carriage, instead of incurring the expense of installing a dynamo on purpose for such use.

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174 Germain St., Buffalo, N.Y.

May 23, 1899.

GORE PARK, HAMILTON.

THE POSSIBILITIES OF LIQUID AIR.*

By Elihu Thomson.

The object of the present article will be to suggest rather than predict directions in which, under certain conditions, liquid air may possibly become a factor in engineering. And in the absence of favorable conditions need it be said that such possibilities will not be capable of realization.

Let us assume the availability of some innocuous gas liquefiable at about one hundred atmospheres pressure, at temperatures easily and cheaply attained, and at no cost for the gas itself. In such a case there can be no doubt of its soon finding enormous application in the storage and recovery of energy. Cheap power would be used to compress and liquefy it, after which it would be stored in quantity, either at atmospheric pressure or at some selected higher pressure. Such a liquefied gas would be stable, or remain in the liquid state, if heat were prevented from reaching it. This could be done, not perfectly, of course, by surrounding the containing vessel with a liberal thickness of some good non-conductor of heat. That part of the gas which would inevitably escape on account of the lack of perfect heat insulation would be cold and would be made to traverse the non-conducting covering in successive layers from within outward, and thus assist in cooling the covering and in preventing access of heat to the liquid ; or, the escaping gas might even be made available for power in an engine, if the liquid were kept under a proper working-pressure. In this case further heating of the gas, analogous to superheating of steam, could be employed before sending it to the engine. But little of the energy of the heat so added would be lost, and a considerable part of it could be supplied by the surrounding air or by water.

With such a liquefied gas produced at one place by cheap power and carried to another for evaporation and recovery of power, ice could be made as a by-product.

In many plants used for the development of power on a large scale, a twenty-four hours' output is not called for, but could be attained at slight additional expense. The excess power from such a plant needs some means of utilization. This excess power, as during periods of otherwise light load, could be employed to liquefy the assumed gas. On a large scale this procedure would not be costly, supposing the use of highly developed machinery. The liquid product could then be transported in tanks provided with heavy lagging and special arrangements to prevent access of heat from the outside. Perhaps it could be distributed by a well-covered pipe-line. The unavoidable evaporation which would be involved in the pipe-line transportation might not be altogether a loss, for if the line be under a pressure suitable for engines the escaping gas might possibly be tapped out at intervals, heated, and used for power along the line of way.

But the foregoing considerations are based upon the existence of a gas at no cost, with desirable properties rendering its liquefaction easy. Such a gas does not in fact exist. There then arises the question whether we can render available any of the gases known to us. Carbonic acid gas is cheap, but still far too costly for use in the way proposed. It would not pay to send it back long distances for recompression and reliquefaction. It costs too much to be thrown away after it has been once used. The air itself meets the condition of no cost for material in the case.

In culmination, Professor Dewar has lately succeeded in reducing even hydrogen to a liquid and in collecting quantities of it. Temperatures not far removed from absolute zero (—273° C.) are obtained by the evaporation of liquid hydrogen. But the absolute zero, like the dynamo of 100 per cent. efficiency, may by each advance be more and more closely approximated but never reached. This low temperature research has shown that at temperatures as low as —200° C., attainable by evaporation of liquid air, conducting-metals, as copper, platinum, silver, etc., when in a very pure state, have their conductivities so much enhanced that electric currents flow with but a fraction of the resistance experienced at ordinary temperatures. Research has shown that at absolute zero they would become perfect conductors. Professors Dewar and Fleming laso found that liquid air is a very perfect insulator, and that ice and many frozen electrolytes even become excellent insulators at the temperatures of liquid air ; and in general that intense cold in insulators improves the insulation, just as it improves the conductivity of conducting-metals when they are pure.

Unfortunately, however, the liquefaction of air requires rather extreme conditions, and in the early work of Dewar was an exceedingly costly process.

The discovery of the fact that air compressed, cooled, and collected in a reservoir at from 100 to 150 atmospheres might be made to liquefy a portion of its own volume, rendered possible the procuring of liquid air by a more direct and simple means. This discovery is claimed by several persons, the merits of whose claims will not be here discussed. When highly compressed air escapes from a suitable orifice it is cooled by its own expansion. If the cooled air be now caused to circulate around a long coiled pipe, which brings the compressed air to the jet in such a way that the portion of pipe nearest the jet is the first to be met by the cooled air, and so back progressively from the jet ; further, if the whole be thoroughly jacketed by a non-conducting covering the temperature at the jet soon falls sufficiently low to cause liquefaction of a portion of the air even at ordinary atmospheric pressure. The operation itself is cumulative or self-intensifying, since the cooling due to expansion is employed, on the regenerator principle, to cool most effectively the compressed gas on its way to the jet and ready to expand.

If air be compressed to about 800 atmospheres it may be made to occupy the same space as it does when liquefied, but even at higher pressures it would remain gaseous. Ordinary temperatures of the surrounding air are far above the critical temperatures of the gases composing it. In order that it may liquefy, it must lose kinetic energy or be cooled ; the velocity of the moving molecules must be brought down. The removal of heat is essential, and the process of liquefaction can only be carried on by cooling the gas during or after compression. Conversely, liquid air confined in a closed and filled receptacle, when allowed to regain the heat lost in being liquefied, would become gaseous and exert a pressure of about 6 tons per square inch.

That the processes for producing liquid air will be developed so as to reduce the cost to an extent such as to render it available in place of a more ideal gas would be a vain prediction to make at present.

The fact that a three-gallon milk-can of liquid air

* Abstract from contribution in the Engineering Magazine.

was brought by Mr. Tripler, of New York, from that city to Lynn, Mass., a journey occupying nine hours, and that not more than one-third of the liquefied gas was lost, although the only covering for heat insulation was about 2½ inches of ordinary steam-pipe felting, goes far toward indicating the possibility of transportation. With a tank of 20 times the linear dimensions of the milk-can referred to, the surface for loss of heat would rise to 400 times, while the capacity would have increased to 8,000 times, and with no better lagging it is easily seen that the daily loss would then not be over 5 per cent. Doubtless, however, improved means for heat insulation would make the loss but a fraction of this amount. If the tank were kept under a pressure of, say, 200 pounds to the square inch, a suitable safety-valve being provided to prevent excess of pressure, the evaporated gas or air could be made to do work, especially if superheated. If the tank were in a train the motive power might, at least in part, be derived from the normal evaporation from the tanks. Further, let us imagine a pipe-line well insulated for heat, and it is easy to see that if the velocity of flow equalled the train-speed in the journey of the milk-can from New York to Lynn, the percentage loss in a pipe of the diameter of the milk-can with no better lagging than it possessed would be the same or even less. Here again perfection of heat-insulation might make quite a saving, and the evaporated gas might, if the line were under pressure, be made available for power along the line of way.

Whether the liquefied gases of the air can be employed in this way will, however, depend upon the development of efficient methods of extracting the heat and effecting condensation of the air.

Liquid air represents air compressed to about 800 atmospheres, but existing without pressure. No heavy and excessively strong tanks are needed for storing it. If it be pumped into a closed receptacle under regulated pressure, it may be evaporated by the heat of the air, or that of surrounding objects, or it may receive heat from bodies undergoing refrigeration, as water being converted into ice; after which heating operation it may be further heated to the melting point of lead by heat of combustion, and be finally used in a suitable engine where its expansion may develop power. During its expansion and delivery of power to the pistons of the engine it may become so cooled as to be discharged from the exhaust at nearly normal atmospheric temperature and pressure.

The power expended in compressing and liquefying air is, of course, converted into heat and thrown away. The product, liquid air, has no inherent power of energy in itself. It represents negativity, bearing somewhat the same relation that an exhausted globe does to the surrounding air. It may become the means for rendering the normal energy in the surrounding air available. Liquid air has capacity for taking up the ordinary heat of surrounding objects and thus acquiring pressure. It can be superheated very efficiently, and so used in the form of compressed air in an engine. The superheating will, of course, tend to raise greatly the total efficiency. The inevitable losses in the compressing and liquefying processes would in part be made up in the added heat, the amount of which is small and efficiently employed. We have no reliable data of large scale operations, and can as yet reach no certainty as to the efficiency attainable in compression and liquefaction or in recovery of power. It is possible that the seperation of oxygen, which would probably possess a value in metallurgy, might tend to diminish the cost of condensation. So also the refrigeration which is obtained during evaporation might help the recovery end. Where so much is "in the air" we must be content with suggestions only, and they may never be realized in practice. The power required to be expended in liquefying a given amount of air can be approximately estimated, and an assumed efficiency of plant may be made to do duty in place of exact figures where none are to be had, and if the conclusions based thereon are understood as tentative and subject to extensive modification in view of further advances in our knowledge, no harm is done.

In making an estimate of the cost of liquid air as produced on the large scale, the factors of plant efficiency, maintenance, etc., come in to a greater or less extent. Assuming that air be compressed as nearly isothermally as possible, and that in a large plant a possible total efficiency of seventy per cent. might probably be realized, each horse power hour might thus be expected to compress nearly 10 pounds of air to a pressure of 2,000 pounds to the square inch. If such compressed air, on being expanded in a very carefully arranged self-intensifying apparatus, should condense 25 per cent. of the air admitted, we would have about 2½ pounds of liquid air per horse power hour. The assumed proportion, 25 per cent., seems not improbable in view of all the data—meagre enough, it is true—which have come to the writer's knowledge.

If the power cost be taken at $20 per year in large units and an additional charge of $10 be allowed for each horse power of the compressing and condensing plant, its interest, maintenance, and operating expenses, the cost per pound of liquid air would be about one-sixth of a cent, assuming the plant to run 7,200 hours per year. This estimate, subject to modification from the very nature of the problem, would make the liquid air cost for production about 8 cents per cubic foot. If oxygen separated by fractional distillation possessed a value for equal amounts in excess of the cost of the air, the remaining nitrogen would, of course, be producible at a lower figure.

It is probably within the possibilities that a cubic foot of liquid air or nitrogen, if allowed to heat from its surroundings and then be further heated to 200° C., could, in a high pressure engine, yield about five horse power hours. If at the same time the vaporization of the air were attended by useful refrigeration, as in making ice, the cost of recovery would diminish. Need it be said here, however, that even if the cost of horse power of recovered energy much exceeded that which is indicated in the foregoing estimates or assumptions, a demand may still exist for a source of power having great compactness, freedom from nuisance, no heated nor noxious exhaust, and of unequalled controllability? The horseless vehicle problem certainly presents us with an instance in point.

The great feature of the application of such a power as liquid air would be its emergency value. By this is meant the ability to obtain at will a sudden output far beyond the normal. Animal power notably possesses this emergency value, and the success of electric trolley systems largely depends upon the fact that, when needed, the station can be called upon for a temporary delivery to any single car or train of a power greatly in excess of the rated output of the motors.

Suggestions have already been made of the use of

liquid air or oxygen, mixed with combustibles as a high explosive. Such an explosive can be made at the time of use, and if left unexploded, either by accident or design, soon loses its dangerous character by evaporation of the liquid gas.

A fascinating speculation for the electrical engineer is the possibility of so cooling the conductors of electric lines or apparatus as to improve the conductivity many times, and so diminish the losses in any given length of conductor, and at the same time greatly improve the insulation. Professors Dewar and Fleming have shown, however, that it is a condition of this enormous improvement in conductivity that the metals be very pure, a very small percentage of impurity greatly lessening the result. As regards the insulation, they have shown that dielectrics and electrolytes become insulators of excellent character when cooled to the temperature of liquid air. What effect such a lowering of temperature would have upon the dielectric strength or striking distance between conductors at great differences of potential is not as yet determined, so far as the writer is aware. The result to be expected from a consideration of the effect of heating upon dielectric strength or striking distance is, that very low temperature will make it far more difficult to break down insulation by sparking through it.

That the electrical engineer covets just such agencies as will thus extend the range of possibilities in his art needs no proof. He would be apt to choose a pipe line conveying liquid air as the very best location for his conductors, assumed to be made of as pure metal as possible, the high insulation probably attainable being the chief object. Whether his conductors were placed outside such a pipe or within the same, he could no doubt adapt himself to the conditions, provided he could get the benefit of the low temperature insulation, and possibly, to a certain extent, a gain in conduction.

It is indeed very questionable whether a pipe line will ever be laid and kept filled with liquid air solely for its electrical benefits, but if such a line were also used to supply liquid air to a distant point and the normal evaporation utilized, the case would be somewhat modified, though the improbability of such a combination being put into service, at least within any reasonable period, still remains.

It will be the proper attitude for the conservative and at the same time progressive engineer to await the possession of full and accurate data before drawing any conclusions as to future practice. Suggestions of possibilities are, of course, useful, even if only a fraction of them prove realizable, and no attempt is here made to do otherwise than call attention to matters which must from their nature possess more or less of interest. —Engineering Magazine.

Mr. R. A. L. Gray, electrical contractor, Toronto, has removed to 42 York street, having secured the agency of the Electrical Construction Company, of London, Ont.

A by-law will be submitted to the ratepayers of Nelson, B.C., authorizing the council to grant a charter for a tramway system in Nelson to the British Electric Traction Co., of London, Eng. The company's solicitor is Mr. W. A. Macdonald.

The United Electric Company, Toronto, have recently sold 2 h.p. motors to the following: Brereton & Manning, Langmuir & Co., T. H. Patriarche, A. R. Williams Co., and Imperial Cap Co., Toronto: Brock Engraving Co., London; R. B. Dobson, Beaverton; R. E. T. Pringle, Montreal. They have also sold to Mr. Dobson one 4 h.p. motor and one 6 h.p. generator, and to R. E. T. Pringle one 6 and one 8 h.p. motors.

SPARKS.

The town council of Barrie, Ont., are taking steps looking to the construction of a municipal telephone service.

Mr. J. L. Kitchen has removed from Wiarton to Acton, Ont., to take charge of the municipal lighting plant in that town.

The Bell Telepone Co. are now constructing a long distance copper line between Ottawa and Brockville. The line will require about 75 miles of poles and cross-arms and 200 miles of copper wire.

Robert Hunter, Joseph Murchey and associates have been incorporated as the Gasoline Engine Co., of Toronto Junction, to manufacture gasoline and gas engines, steam engines, electric motors, etc.

The council of Wallaceburg, Ont., have refused to grant an electric light franchise to Mr. M. Martin, and have entered into an agreement for street lighting with the Wallaceburg Electric Light Company.

The ratepayers of the village of Thurso, Que., have approved of the by-law to raise $18,000 to purchase and complete the waterworks and electric light plant started last year by the Stadacona Electric & Water Co.

The town of Renfrew, Ont., has given a contract to A. A. Wright & Co. for six arc lights, at 25 cents per light per night, and to W. A. Mackay for 15 incandescent lights, at $20 per light per year, both contracts to be for one year from May 3rd, 1899.

The Bear River Electric Light & Power Company have decided to extend their system to Digby, and to light intermediate points. The capital has been increased to $75,000, and it is understood they will take over the plant at Digby owned by Major Daley.

A syndicate of Toronto gentlemen are said to have purchased the franchises and property of the St. Hyacinthe Power and Electric Light Company and the St. Hyacinthe Gas Company, of St. Hyacinthe, Que. It is given out as the intention of the syndicate to rebuild a portion of the dam at the power house and to remodel the electric system.

The Hull Electric Company has entered suit in the Superior Court against the Ottawa Electric Company, claiming $10,000 damages for non-compliance with their request to cease selling light in Hull. This sum is alleged to have accrued since the last action for $20,000 on the same grounds was issued. The latter is still pending before the Court of Appeal in Montreal.

Oliver Perks, an electrician, of Montreal, was recently killed at the power house of the Chambly Manufacturing Company at Chambly. Perks and some other employees were laying the current on a new machine. Perks wanted to find out for himself the progress being made on the machine. He leaned over it, putting the tips of his fingers on the frame and stretching his other hand down. In the act his hand came in contact with some wire, thereby establishing a circuit and causing a current of 3,000 volts to pass through his body. Death was almost instantaneous.

Recent sales made by the United Electric Company, Toronto, include the following: 3½ h.p. motors to J. T. Rowan, Ottawa, and Telegraph Printing Co., Waterloo; 4 h.p. motors to Merchants Mantle Manufacturing Co., Toronto; 5 and 6 h.p. motors to Citizens' Telephone & Electric Co., Rat Portage; 7 h.p. motor to James Sparrow & Co., Toronto; 8 h.p. motors to Federal Printing Co., Ottawa, Toronto Lithographing Co., Northway & Sons, and Elliott Paper Box Co., Toronto, Clark Creamery Co., Smith's Falls, and Darling Bros., Montreal; 10 h.p. motors to Brown & Hussey, Toronto, Rogers Coal Co., Hamilton, and W. J. Babcock, Brantford; 12 h.p. motors to Elias Rogers & Co. and A. R. Williams Machinery Co., Toronto; 20 h.p. motor to Rice Lewis & Son, Toronto.

The Cataract Power Company have made a proposition to light the streets of the city of Hamilton, the contract to apply to the unexpired term of the existing contract with the Hamilton Electric Light & Power Company, viz., September 1, 1900, and for a further period of ten years. They offer to furnish 425 arc lamps of 2,000 nominal candle power, burning from dusk till dawn of every night of the year, at the rate of $85 per lamp per year, and additional lamps at the rate of $82.50. Should the city require 500 lamps or over at any time during the term of the contract, the price would be $82.50 for the first 500 lamps and $80 for each additional lamp. A rebate of 2 cents per lamp hour to be made for such time as the lamps may not be burning. The company announce their intention, should the proposition be accepted, of thoroughly remodelling the present arc lighting system.

ELECTROLYSIS.*

By F. Walter Thorold.

The great damage done to gas mains, water mains and the cables of the various electric and telephone companies by the return current of the electric railway systems, is now assuming such large dimensions that something must be done to overcome it. If this trouble is left to take its own course, there will, no doubt, be numerous law-suits in which the railway companies will be the losers. They will have to pay for damages done to these pipes and cables, and will also have to so equip their outside plant that this trouble will not occur again.

There may be a doubt in the minds of some people as to whether the electric railway companies can be held responsible for the damage done by their heavy return currents. The argument amounts to this: Certain companies have capital invested in metal, which is placed underground. Another company comes along and destroys this metal. The question then is, is this last company responsible for the damage they have done and are still doing? They may not be doing this damage intentionally, but they are doing it knowingly.

It is a well-known fact that electricity will choose the path for itself which offers the least resistance, but that it is impossible to confine the current to one conductor when there is another open for it, no matter what the resistance of the other may be. Still, it is the duty of the electric railway companies to provide a conductor on their return circuit over which the greater part of the current will flow, and that conductor must offer so little resistance that all the current which does not return over it will not be enough to cause any damage to the underground pipes and cables.

Electrolysis may result to a small extent from the leakage of overhead wires, but as this leakage takes place to such a very small extent, it is not worth considering. Of course, any large leakage of this kind, or a "ground," as it is called in practice, would soon be known at the power house and taken off at once.

The circuit of the ordinary trolley system is very simple. The current comes along the trolley wire from the dynamo in the power house, thence through the car to the rail, and along the rail and underground pipes, etc., back to the dynamo in the power house. If the current all returned along the rails there would be no damage done by electrolysis, excepting perhaps at a few bad joints between the rail and its connections.

A few words might be said as to the connections between the rails now generally used. The rails are bolted together by means of ordinary fish-plates; but to make a better electrical connection they are bonded together by heavy copper wire. This bonding is supposed to so connect the rails that the current will flow on unmolested to the power house. The method of bonding now used is to take a piece of No. 0 or No. 00 bare copper wire, as short as possible, but generally about eighteen inches in length, to each end of which a rivet, called a channel pin, is soldered. There is a small hole drilled in the end of each rail, into which the channel pin is put, and the end is then flattened out, thus connecting the rails together. However, it has been found that this is not enough, as some of the current leaves the rail, on account of the resistance between the joints, and follows along the underground mains and cables to the power house. If the current, while travelling along these pipes, was not increased or diminished on the way, or in other words, if the potential between the pipes and the rails was always the same, there would be comparatively little harm done. The trouble is that the current takes jumps to and from the pipes as the resistance of the rail increases or diminishes, and at every point in the pipe where this takes place—and the points are many—electrolysis sets in.

The method of bonding before mentioned does not make a true electrical connection. The connection between the pin and the wire may be all right, but it is the connection between the pin and the rail which causes the trouble. By continual pounding of the cars on the rail the joint is loosened, and the result is that an oxide of the metal is formed, thus increasing the resistance of the joint, and ultimately of the whole circuit, and thereby causing more of the current to return through the pipes, etc.

One system which is used is to connect the rails every short distance with an overhead insulated copper wire, which carries the current back to the power house. Of course, the system of bonding mentioned is also used, or otherwise it would be necessary to connect every rail with the overhead wire. It will be readily seen that with so little resistance offered, very little of the current would seek any other path.

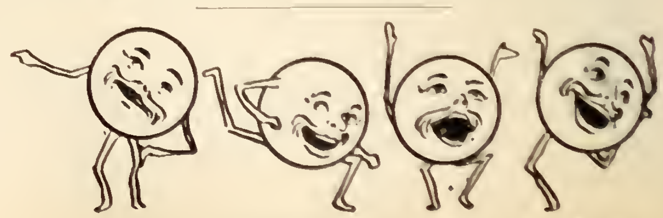
A sixty-pound rail is said to be electrically equivalent in carrying capacity to one square inch of copper, and therefore, in a double-track road, the rails offer a combined carrying capacity for the current equal to four square inches of copper. If the bonding between the rails is made perfect, and the overhead return wire is used, then I think the trouble of electrolysis would be a minimum.

In several cities the rails have been casted together at the joints by placing a mould about the rail ends and pouring molten iron in, which on solidifying formed a solid joint. A first-class electrical connection may thus be obtained, but it has been found to be almost impossible to have an easy running road with joints of this kind, and as this is an expensive connection, it is not very largely used.

The effect of electrolysis is first noticed near the power house, as it is near this point that the current, which has been collecting on the pipes, jumps up to the rail to return to the dynamo, thus causing the oxidation of the pipes at this point. This oxidation, it must be remembered, has been and is going on at many other points of the pipes, although not to such a great extent, but it is only a matter of time when the same trouble will be located on these other sections of the pipe, throughout the city or town.

Outside of all damage done to other property, the electric railway companies are wasting money. To decompose a metal some force must act, and in this case the force is supplied by the railway company. They are, therefore, spending money to decompose these metals, as well as spending money to operate their cars. Why not put in good return wires and save this money? The saving just now would be a negative quantity, but in the end they would probably be the gainers.

* Abstract from pamphlet of Engineering Society of School of Practical Science, Toronto. Published by permission.



The joys of Anticipation—The Realization can be had by attending the Electrical Convention at Hamilton.

THE LATE DONALD GIBSON.

THE late Donald Gibson, city electrician of Toronto, whose portrait appears on this page, was one of the best known of the older citizens. His connection with the fire brigade as superintendent of the fire alarm system extended over the long period of twenty-seven years. Mr. Gibson was a native of Glasgow, Scotland, and came to Toronto in 1854, to enter the service of the Consumers' Gas Company. He was foreman there

THE LATE DONALD GIBSON.

until he entered the city's service. He was an ardent volunteer. As a lieutenant in the Highland Company of the Q.O.R., he was present at the Ridgeway fight. Afterwards he became captain of the Garrison Artillery. He was a first-rate rifle shot, and was a member of the first Wimbleton team sent from Canada. Mr. Gibson was one of the founders of the Caledonian Society, a strong Reformer in politics, and a member of Old St. Andrew's church.

SPARKS.

The United Electric Company, Toronto, have sold a 1½ k. dynamo to Toronto University.

Tenders have been invited for wiring for electric light the municipal buildings at Winnipeg.

Ed. Plante and Z. Plante have formed a partnership in Montreal as electricians, under the firm name of Plante & Co.

Some improvements have recently been made to the electric light plant at Huntsville, Ont., under the superintendence of Geo. Ralstan, electrician.

Mr. Champagne, boiler inspector, Montreal, in a report to the Water Committee, recommends the addition of a pump of 5,000,000 gallons capacity, either worked by steam or electricity.

Steps have recently been taken to form a trust of the manufacturers of rubber covered wire in the United States. Options have been obtained on the purchase of the business of the leading firms.

The authorities of the town of Goderich, Ont., will probably make an addition to the electric light plant. The Light Committee have recommended that the council purchase 1,900 feet of No. 6 insulated wire.

The Lunenburg Gas Co., of Lunenburg, N.S., have changed their lighting system from direct current by steam to alternating current by water power, and are offering for sale their entire direct current plant.

The London Electric Company are still engaged in the work of remodelling their power house, and have placed an order with the Canadian General Electric Company for a complete marble panel switchboard, consisting of sixteen panels.

The Quebec government will offer for sale on June 8th the water power of the river Ottawa, opposite the township of Onslow, comprising the rapids and falls of Les Chutes des Chats. The purchaser must agree to spend $300,000 within three years in developing the power.

It is estimated that in the United States nearly 1,000,000 h. p. produced by electricity is used annually for the driving of pulp machinery. Such an extensive application reiterates the necessity for electrical engineers to become acquainted with the laws and practice of hydraulic engineering.

The Canada Tool Company, of Dundas, Ont., are in receipt of a large order from the Dominion Bridge Company, of Montreal, for special machinery. The large punches are to be operated electrically by motors directly attached to the machines, and for this purpose an order has been placed with the Canadian General Electric Company for four of their latest enclosed slow speed C.E. motors.

The city of Winnipeg, Man., have invited tenders for the supply of one 100 h.p. high speed engine for electric light plant, together with shafting, pulleys, belting, etc.

Mr. J. P. Graves, manager of the Granby Consolidated Mining & Smelting Company, states that it is the intention of the company to build a large smelter at Grand Forks, B. C. The smelter will be located on the Kettle river, power to be obtained by damming the river at a narrow canyon one mile above.

The British Columbia Electric Railways Company, of Vancouver, B. C., have declared their first dividend of 5 per cent. per annum on preference stock and 4 per cent. on ordinary stock. During last year the company made profits of $81,000, half of which was devoted to paying the dividend and the balance placed in reserve.

The Still Motor Company, Limited, of Toronto, has been granted provincial incorporation, with a capital of $75,000, to manufacture batteries and other appliances for propelling carriages, street cars, etc. The provisional directors are W. J. Still, Thos. Bengough, L. W. Doran, C. W. Chadwick and Joseph Heighton.

Messrs. Thos. Ahearn, John Murphy and W. Wylie, of Ottawa, visited the Electrical Exhibition in New York last month. Mr. Ahearn states that there was a splendid exhibition of horseless carriages, from automobile hose wagons to broughams. It is probable that the Ottawa Car Works may manufacture automobiles at an early date.

The Trenton Electric Company, of Trenton, Ont., expect to have their transmission lines at Belleville, Ont., completed very shortly, when they will be in a position to furnish power to the various manufacturers of that place. Mr. R. J. Graham is one of the first to avail himself of this power, and has alrdady contracted for about 50 h.p. He has also placed an order with the Canadian General Electric Company for one 30 h.p. and one 10 h.p. three phase induction motors for operating refrigerating machinery, hoists and fans in his cold storage establishment.

The Montreal Cotton Company, of Valleyfield, P.Q., are making some very extensive additions to their electric plant. They have at present installed four 600 h.p. three phase generators manufactured by the Canadian General Electric Company, and have just placed an order with the same company for a large 2,000 h.p. generator of the revolving field type, together with switchboard panels complete. They have also ordered two 85 k.w. exciters, these having sufficient capacity for furnishing exciting current to the full equipment of generators. Upon the completion of this additional installation this company will have the largest and most up-to-date isolated power plant on the American continent.

Mr. W. H. Whiting, of Boston, Mass., has patented an electrical fire engine, mounted on wheels like a steamer and consisting of a rotary pump and electric motor. It is 25 per cent. lighter than the average steam engine and the motor has double the power. The current for running the motor is obtained by erecting a post about ten feet from the hydrant, and connecting this with the nearest source of electrical supply. The current is transferred from the switch-box on a post to the engine by two flexible conductors, which can be attached instantly and the engine be ready for use before the hose is laid.

The Canadian General Electric Company are introducing a series alternating arc lighting system to their patrons, which permits of the operation of arc lamps in series from an alternating current generator of any standard periodicity. This will undoubtedly fill a long felt want and will tend to revolutionize the systems now in use for street lighting. Appreciating the advantages to be obtained, the Sherbrooke Gas & Water Company, of Sherbrooke, Que., have placed an order with the Canadian General Electric Company for a complete equipment of one hundred of these lamps, with transformers.

The Railway & Engineering Review states that the North-Western Elevated Railway Company, of Chicago, has entered into a contract for 150,000 pounds of aluminum feeders. Three sizes of bare cables will be used, viz., 786,000, 1,000,000 and 1,300,000 circular mils in area respectively. The largest feeder will be about 1½ inches in diameter. Of the two larger sizes there will be two cables of more than 10 miles in each. The feeders will be placed in a wooden box or trough covered by a board walk, between the tracks, and they will be supported on virtrified clay rocks of umbrella shape, placed 9 feet apart. The contract was made on the basis that 47 pounds of aluminum are equal in conductivity to 100 pounds of copper. Experiments carried out by the electrical engineerig department of the road have demonstrated that 157 circular mils of aluminum are equivalent in carrying capacity to 100 circular mils of copper.

For some months past it has been reported that the water power at Fenelon Falls, Ont., was to be developed for the purpose of transmitting electric power to Lindsay, Ont., a distance of 14 miles. We are informed that the undertaking has been definitely decided upon by the Light, Heat & Power Company, of Lindsay, who expect to have the new plant in operation by the 1st of October. They have commenced the work of construction and are arranging plans for the development of about 1,200 horse power. The electric plant will eventually consist of two 400 k. w. three phase generators direct coupled to turbines. They have placed an order with the Canadian General Electric Company for one 400 k.w. generator, together with switchboards, step up and step down transformers, and all the apparatus required to complete the electrical installation. We expect to give a detailed account of this enterprise in our next issue.

ELECTRIC RAILWAY DEPARTMENT.

ELECTRIC RAILWAY IN JAMAICA.

The following account of the electric railway at Kingston, Jamaica, of which Mr. H. Holgate, late of Montreal, is manager, is given by the United States consul there :

For some years there has been a mule railway in Kingston, but an electric road covering the lines of the old cars and other thoroughfares as well has just been completed. This new line has about 25 miles of track in and around Kingston, divided into three districts, viz., the lines north of the city, those east of the city, and those in the city. It is a private enterprise, started by Canadian capital, and is called the West India Electric Company. The Government license is for a period of 30 years, renewable for further periods at the pleasure of the governor. The company pays four per cent. of its gross earnings to the government, and assumes the maintenance of the roads and streets occupied by it to the extent of 18 inches on each side of the tracks.

The rates of fare are 4 cents for each passenger from any point within a district to another point in the same district by most direct route; that is, the fare is practically 4 cents for each section of the line, and from the end of the line to the east, through the city to the end of the line north, would be three fares, or 12 cents. In addition, the company reserves three front benches on each car, on which a first-class fare—6 cents—is charged. The tickets are sold as follows : Seven 4-cent tickets for 24 cents, five 6-cent tickets for 24 cents, and ten children's tickets, for under 12 years, for 24 cents.

Passengers are allowed to stand. There are no restrictions as to number of passengers carried, and the same complaints of overcrowding are heard. Cars run every 15 minutes in the city. In addition to regular motors, this company runs market cars before 9 a. m. and after 5 p. m. for country people who carry produce. These cars are trailers, and the fare on them is 3 cents.

STREET CAR FENDERS.

Mr. Duncan McDonald, superintendent of the Montreal street railway system, recently spent a couple of weeks in the United States, on a tour of inspection of the various railways in the principal eastern cities, with a view, particularly, of investigating the merits of the different fenders in use. He found that most every class of fender that has been invented was used. It had been proved, however, in actual operation, that if a person lay down on the track in front of the car or fell sideways, it was impossible to save him. This had been the verdict on all fenders now in use. While one of the best advertised fenders in the United States was on trial recently in Cincinnati, a fatal accident resulted, and this was the very first day of its use. These facts had driven railway men to the opinion that the old reliable maxim of "stop, look and listen when crossing a street car track," was the most reliable life saver up to date.

Mr. McDonald is now preparing a report on the subject, giving all the details at his command, and his opinion is that a combination fender, which will unite the best points of the various ones now in use, will eventually be adopted.

Concerning street car systems, Mr. McDonald says that Montreal can justly claim to have one of the best in existence. Nowhere did he find a two-minute service as is given in Montreal. The nearest approach to it is in Boston, where they are running a two and one-half minute service on one route from 5 to 7 p.m. For the balance of the day in Boston nothing is closer than five minutes.

In every place Mr. McDonald visited, he found interesting and instructive details of maintenance and operating that might be profitably applied. The Boston subway is not only admirable as a well-planned monument of engineering skill, but it is also one of the greatest achievements in the science of operating cars and handling large crowds with safety and despatch. The arrangement of traffic on Brooklyn bridge was another example of the time that could be saved by proper facilities and a little hustling on the part of the people. The absence of grades in most large American cities afforded much more economical maintenance than could be shown with the heavy hills as in Montreal.

CANADIAN CAPITAL IN NEWFOUNDLAND.

Mr. R. G. Reid, of Montreal, who holds extensive franchises from the government of Newfoundland, has concluded arrangements for the immediate construction of an electric railway and lighting system in the city of St. Johns. The contract for all the electrical apparatus for the street railway, power and lighting plant has been awarded to Messrs. John Starr, Son & Co., of Halifax, who are agents in the Maritime provinces and Newfoundland for the Westinghouse Company. The generating station will have a capacity of 1,500 h.p., which will be transmitted eight miles to St. Johns, and there distributed from a sub-station. Step-up and step-down transformers will be used, the current being transmitted at 15,000 volts. The 500-volt direct current for the street railway will be derived from rotary converters. The contract for cars has been placed with Messrs. Lariviere, of Montreal, that for trucks with the Canada Switch Co., of same city, while the Stillwell-Bierce & Smith-Vaile Co., of Dayton, Ohio, will supply the hydraulic machinery. The first cars are to be delivered by August 1st.

SPARKS.

The Board of Trade of Three Rivers, Que., has set in motion a project for the building of an electric railway from that city to Grand Mere.

Berlin citizens are agitating for an extension of the present Berlin and Waterloo electric railway through German Mills, Doon and Blair to Galt.

At the annual meeting of the Hamilton, Ancaster & Brantford Electric Railway Company, held last month, the directors were re-elected. The company still requires $20,000 to make up the necessary capital of $60,000.

The employees of the London Street Railway Company are again on strike. It is probable that the question in dispute will be submitted to arbitration, the employees and the company having agreed to this course.

A bill to incorporate the Ontario & Quebec Bridge Company was thrown out by the Railway Committee of the Dominion Parliament. This was a bill to build a bridge from Bank street, Ottawa, to the city of Hull, so that the Hull Electric Railway Co. might carry passengers into Ottawa. The bill was opposed by the Ottawa Electric Company, which has a thirty year monopoly for an electric street railway in Ottawa.

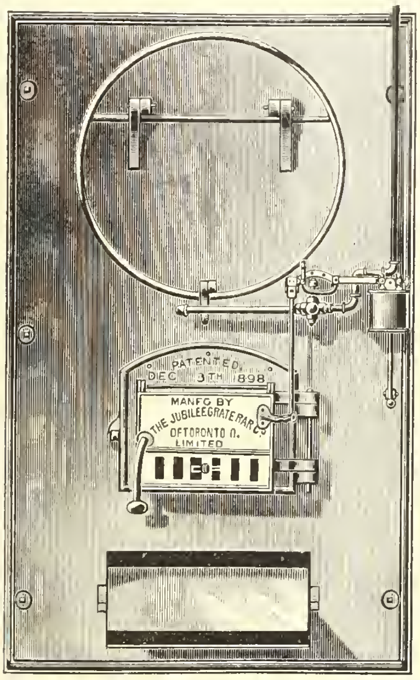
The Peterboro and Ashburnham Street Railway Co. have made a proposition that the corporation take possession of the railway, extend and improve it, and operate the road for a term of five years, without any allowance to the company, the understanding being that all capital expedinture shall be made with the concurrence of the owners, who shall have the right at any time within the period named to resume possession on repayment to the town of the sum expended on capital account, together with interest.

The Montreal Belt Line Railway Co. recently applied to the Railway Committee of the Dominion Government and to the Montreal council for permission to run its line from the north side of Duquette street to the Dominion Cotton Mills, within the limits of the city of Montreal. The Montreal Street Railway Co. protested on the ground that it had a right of preference over every other company, or in other words, that it held an exclusive franchise. The matter was referred to the city attorney, who has ruled that the corporation of Montreal, in giving the Montreal Street Railway rights and licenses, did not grant a monopoly for exclusive privileges. The city, he states, can grant the Montreal Belt Line Railway permission to run its line on Division street without violating the contract with the Montreal Street Railway Co.

Are you a member of the Canadian Electrical Association? It not, send in your application at once and take a hand in the forthcoming Convention at Hamilton.

THE REDPATH-REID AUTOMATIC SMOKE BURNER.

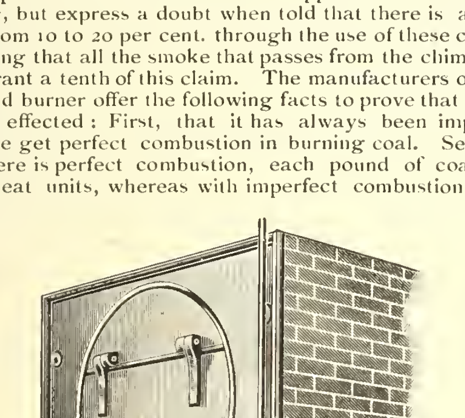
For a number of years engineers and mechanics in all parts of the world have been working diligently with a view to perfecting apparatus for consuming the smoke of boilers, and their efforts have in some instances been rewarded by a degree of success. This question has been given much attention by the patentees of the Redpath-Reid automatic smoke burner, who now claim to have perfected a machine which embodies all the elements which go to make up a high-grade invention, viz., efficiency, simplicity,



THE REDPATH-REID AUTOMATIC SMOKE BURNER.

and durability. Their smoke consumer is not a new system, but an old one improved and modernized.

Many persons will admit that the apparatus burns the smoke perfectly, but express a doubt when told that there is a saving in fuel of from 10 to 20 per cent. through the use of these consumers, contending that all the smoke that passes from the chimney would not warrant a tenth of this claim. The manufacturers of the Redpath-Reid burner offer the following facts to prove that the saving in fuel is effected: First, that it has always been impossible to otherwise get perfect combustion in burning coal. Second, that when there is perfect combustion, each pound of coal gives off 14,500 heat units, whereas with imperfect combustion not more



THE REDPATH-REID AUTOMATIC SMOKE BURNER IN OPERATION.

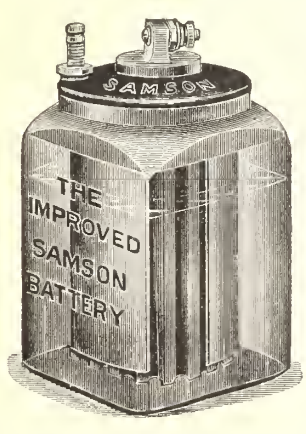
than 4,600 heat units are likely to be obtained. Third, if all the smoke in the fire box is burned, the heat does not have to penetrate through from 1/32 to ¼ inch of non-conducting substance. Fourth, that invariably the greatest heat in the coal is near the grate bars, the top of the coal being coaked over and presenting a dull red glow until broken up. Fifth, some days the draught, owing to the state of the atmosphere or direction of the wind, may be very sluggish, and here again economy is sacrificed.

In using smoke consumers, it is possible to attain nearer to perfect combustion than in any other way, and a perfectly white blaze instead of unconsumed carbon passes through the tubes. The hottest fire is on top of the coal instead of under the surface, and the draught is always strong and cannot be effected in any way by the wind or atmosphere. A better understanding of the Redpath-Reid automatic smoke burner will be obtained by reference to the accompanying illustrations. The manufacturers are the Jubilee Grate Bar Co., of Toronto, who have already disposed of some provincial rights, and have others to sell for Quebec, New Brunswick and Nova Scotia.

THE IMPROVED SAMSON BATTERY.

The steadily growing demand for storage batteries is causing manufacturers to give much attention to perfecting improvements tending to increase their efficiency. We are advised by Messrs. John Starr, Son & Company that they have just made a change in the style of the well known Samson battery.

The improvement consists mainly in joining the carbon, zinc and cover in such a way that it is impossible, they claim, for a short circuit to occur between the elements when inside the jar. The cover is made of a hard dense material, into which is locked the carbon. The cylinder zinc is firmly held to the cover by a nut, and the result is, mechanically speaking, a one-piece battery which can be handled as such, thus dispensing with the rubber rings, etc., previously used. The carbon is held half an inch away from the bottom of the jar, and the zinc is a trifle shorter than the carbon. This is to save possible bridging of salts. The battery is shipped, set up, and to use same it is only necessary to remove the packing. The great advantage of this method, especially in the case of inexperienced persons using battery, will be recognized. It also faciliates the handling of same. The shape of the jar has also been altered, so that the whole appearance of the battery is very much improved.



Concerning the "Sampson" carbon the manufacturers say: It is manufactured in France and is composed of two parts, a fluted lower portion and a flat top carrying the binding post, which are baked into one piece in the kiln. The lower portion is a thin-walled, fluted, hollow cylinder, made from special materials, and by a special process, resulting in a quality of battery carbon which, as is the case with some natural products, cannot be obtained in this country. The top portion is composed of an entirely different kind of carbon from that used in the lower portion, which, after being subjected to enormous pressure, is treated when the carbon is complete in a way which renders it impervious to the creeping tendency of the solution and action of the ammonia gas.

The upper and lower portions, after being formed, are properly baked in the kiln, after which the top of the carbon is heated red hot and plunged into hot parafine, so that it enters into the minutest pore instead of simply collecting on the outside.

A combination of manganese and pea carbon is placed inside the fluted portion and held in position by a specially prepared plug which will not fall out. It is this depolarizer and its close proximity to the exceptionally porous carbon which imparts to the battery its remarkable recuperative qualities.

The result of the thorough and necessarily expensive mode of manufacture is the production of a battery carbon which has a larger surface, longer life and greater recuperative power than any other carbon element ever manufactured.

An improvement has also been made in the carbon binding post connections, which are bolted on across the top of the carbon, and is held in place by a safety check nut.

Messrs. John Starr, Son & Co. have recently appointed Mr. John Forman, of Montreal, agent for the provinces of Ontario and Quebec. Mr. Forman will carry a large stock of these batteries, and will be prepared to supply the trade promptly.

SPARKS.

The Bell Telephone Company is installing a municipal fire alarm system at Cowansville, Que.

A number of Peterboro' gentlemen are endeavoring to form a company to establish an automobile carriage service between Peterboro' and Chemong.

Mr. P. Alexander, electrician, of Peterboro', has recently completed the wiring for electric light of Geo. Matthews & Co.'s extensive establishment in that town.

The Town Council of Orillia, Ont., have submitted an offer for supplying light and power for the Asylum for Idiots, agreeing to put in a 750 light transformer and a 30 h.p. transformer for the sum of $1,400 per annum, on a five or ten years' contract.

Sales of small motors have lately been made by the United Electric Company, Toronto, as follows: 1 h.p. motor to E. S. Stephenson, St. John, N. B.; ½ h.p. motor to Brock Engraving Co., London; 3 h. p. motor to Lindsay Light, Heat & Power Co.

The Empire Heat and Light Co., of Westfield, N.B., is seeking incorporation, to deal in smoothing irons and all kinds of gas, electricity, and forces for power and heating purposes. The capital is $30,000, and the promoters are St. John citizens, including J. J. Porter and F. Calkin.

TRADE NOTES.

The Land Security Company of Toronto have ordered a motor for hoisting purposes from the Canadian General Electric Co.

The Canadian General Electric Company are installing a 100-light plant for the Beaver Portland Cement Company, of Montreal.

We regret to learn that the Ottawa Porcelain and Carbon Co. have decided to permanently close down their factories and liquidate their affairs, owing to the unprofitable results of the enterprise.

The Dominion Bridge Company, of Montreal, have placed an order with the Canadian General Electric Company for a G. E. 1,000 motor equipment, with special resistances, to be used for operating their heavy plate rolling machinery.

The Sprague Electric Company, of New York, have appointed Messrs. Jack & Robertson, of Montreal, Canadian sales agents for their well known electrical apparatus and supplies, including Lundell motors, generators, Greenfield interior conduits, etc.

Mr. F. S. Pearson, of New York, consulting engineer for the Cuban Electric Co., has awarded the contract for two 230 horse power engines to the Robb Engineering Co., of Amherst, N.S. They are for an electric railway from Regla, on the opposite side of the harbor from Havana, to Guamacoa, about eight miles distant.

Mr. Henry F. Duck, who for several years represented the Rathbun Company, of Deseronto, has been appointed Canadian agent for the Engineering Contract Company, of New York, and has opened offices in the Temple Building, Toronto. The company make a specialty of the construction of water power dams, foundations, canals, caissons, etc. Attention is directed to their announcement in our advertisement pages.

The United Electric Company, of Toronto, report the sale of 25 h.p. motors to the Schofield Woollen Company, Oshawa, and the Rat Portage Lumber Company, of Rat Portage. They have also sold an 80 h.p. generator to the Dominion Bridge Company, Lachine, Que., a 25 h.p. generator to John Bertram & Sons, Dundas, and a 60 light dynamo to the Journal Printing Company, Ottawa.

The Smart-Eby Machine Company, Limited, is the name of a new enterprise recently established at 191 Barton St. east, Hamilton. This company are engaged in the manufacture and sale of pumping machinery, steam, gas and gasoline engines, boilers, etc. Mr. Smart, who was a former resident of Hamilton, was recently connected with the Goldie & McCulloch Company, of Galt, and the Jenckes Machine Company, of Sherbrooke, and has therefore a practical knowledge of this business.

A very attractive catalogue has reached us from the Goldie & McCulloch Company, of Galt, Ont., descriptive of their "Model" gas and gasoline engine. A number of excellent illustrations are given, illustrative of the appearance and construction of the machine, accompanied by sketches showing the old fashioned method of obtaining power by means of windmills and such like antiquated devices. The catalogue is well designed to interest readers in modern methods of power development, and particularly in the advantages of the special engine to which the catalogue refers.

The Gasoline Engine Company has recently been incorporated and commenced business at Toronto Junction. The company have secured the right to manufacture in Canada the Olds gas and gasoline engines, which have been successfully manufactured and operated for some years in the United States. One of the members of the Canadian company was formerly connected with Olds Gas Engine Works Company, at Lansing, Mich., where these engines have, for some time past, been manufactured. The new company have therefore the benefit of practical experience in this line of manufacture.

The attention of young men who may be desirous of obtaining a knowledge of electricity and mechanical engineering is directed to the announcement in our advertisement pages of the Electrical Engineer Institute of Correspondence Instruction, of New York. This institute is designed to impart instruction in the above mentioned subjects by the correspondence method, which has been found to be a satisfactory substitute for attendance at engineering schools. Full information as to method, fees, etc., will be forwarded to any of our readers who may make request for the same, referring to the advertisement in the pages of this paper.

In a suit instituted by The Penberthy Injector Co., to restrain the Lee-Penberthy Manufacturing Co., of Detroit, from using the name Penberty, the Supreme Court of Michigan has decided in favor of the complainant, and ordered the latter company to discontinue the use of the name Penberthy in their corporate name and on their Lee injector. In compliance with this order, the defendants in the above suit advise us that in future they will carry on business as the Lee Injector Manufacturing Company. The decision will not interfere with any parties who have purchased Lee injectors in the past, the decree of the courts being that the word Penberthy must not be used in any form in the future.

LONG DISTANCE ELECTRICAL TRANSMISSION IN EGYPT.

Mr. Francis Fox, a member of the celebrated English engineering firm of which Sir Douglas Fox is the head, and whose offices are at No. 26 Victoria St., Westminster, London, is at present on a visit to Canada and the United States, accompanied by his nephew, Mr. Bertram Fox, a young electrical engineer connected with the firm of Siemens Bros. The object of Mr. Fox's visit is to obtain information with regard to electric traction development and methods on this continent, and the methods of utilizing water powers for the transmission of electricity.

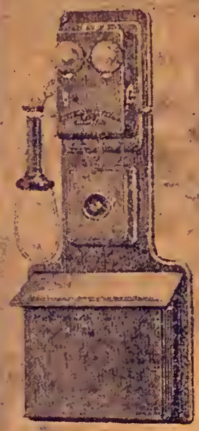
In company with Mr. C. J. Crowley, of Toronto, the Messrs. Fox inspected the power station of the Toronto Electric Light Company, the Toronto Street Railway Company, the works of the Cataract Power Company at Hamilton, and the generating stations at Buffalo and Niagara Falls. They also made a trip over the railway at Lockport, and had an opportunity of inspecting the operation of the two 45 horse power electric locomotives in use on that road. They afterwards visited the works of the principal electrical companies in Montreal, together with those of the General Electric Company at Schnectady, New York. From thence they go to New York, where they will embark for Great Britain.

The information acquired on this visit is intended to be used in connection with the proposal to utilize the Zambesi Falls to generate electricity for the operation of the railway to the city of Cairo, in Egypt. It will be remembered that Mr. Duncan Forbes, who was consulting engineer for the Cataract Construction Company at Niagara Falls, recently made mention of this proposal. The firm with which Mr. Fox is connected are interested in the project. The Zambesi Falls are described as being 450 feet high, the river leading to them broadening out immediately before reaching the precipice over which the water falls perpendicularly into a narrow gorge shaped like the letter "S." The form of this gorge, with its projecting points of land, renders it possible to place a power station in close proximity to the Falls, and obtain the benefit of the full force of the water. The electricity generated at this spot would have to be transmitted a distance of 200 miles, which Mr. Forbes has declared to be feasible. The further progress of this enterprise will be watched with the greatest interest throughout the world.

Mr. A. J. Coriveau, of Montreal, is said to have interested United States capitalists in his Lake Champlain and railway enterprises.

The Canadian General Electric Company have just received an order from Mr. E. Keefe, of Halifax, for one of their standard 25 kilowatt direct driven units for the lighting of the new elevators which he is erecting for the Intercolonial Railway.

The Canadian General Electric Company are in receipt of an order from the Canadian Pacific Railway Company for two of their standard 40 kilowatt direct connected generators, with Ideal engines. These are to be used for the lighting of their new passenger depot at Vancouver, B. C.



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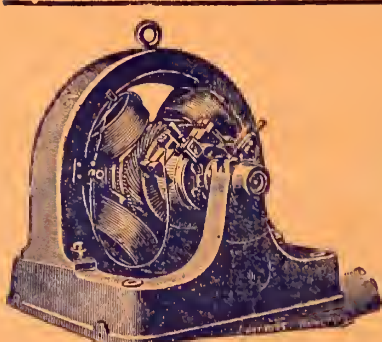

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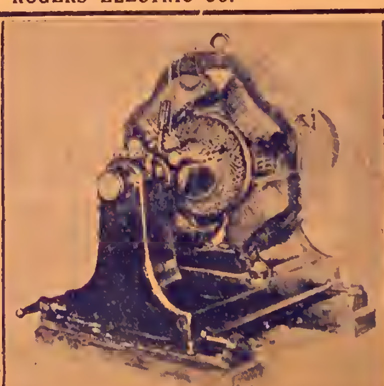

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This Number of the ELECTRICAL NEWS contains a complete report of the Ninth Convention of the Canadian Electrical Association.

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NEW SERIES, VOL. IX.—No. 7.

JULY, 1899

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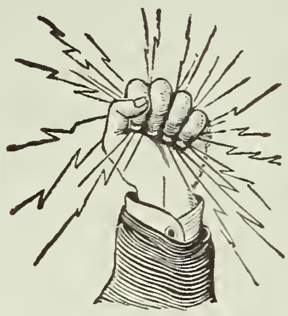

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EXPENSE: The furnace of a water tube boiler requires relining with fire-brick frequently, a large item of expense which is not required with our boiler.

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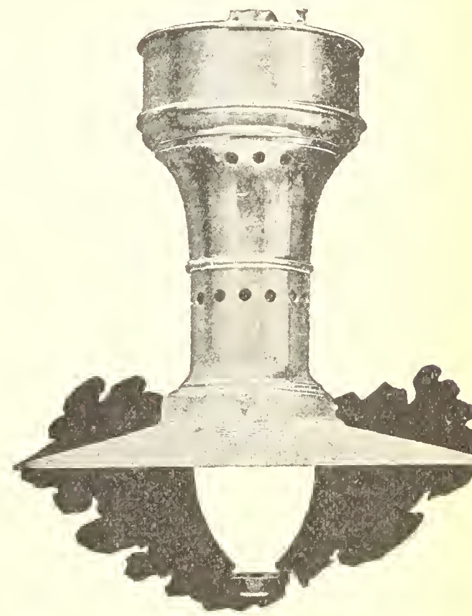

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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. IX. JULY, 1899 No. 7.

MEMBERS AND VISITORS, CANADIAN ELECTRICAL ASSOCIATION CONVENTION, HAMILTON, JUNE, 1899.

CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

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Advertising rates sent promptly on application. Orders for advertising should reach the office of publication not later than the 28th day of the month immediately preceding date of issue. Changes in advertisements will be made whenever desired, without cost to tbe advertiser, but to insure proper compliance with the instructions of the advertiser, requests for change sbould reacb the office as early as the 26th day of the month.

SUBSCRIPTIONS.

The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or the United States, post free, for $1.00 per annum, 50 cents for six months. The price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cheques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in the General Postal Union $1.50 per annum. Subscriptions are payable in advance. Tbe paper will be discontinued at expiration of term paid for if so stipulated by the subscriber, but where no such understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of b is journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

CANADIAN ELECTRICAL ASSOCIATION.

MARITIME ELECTRICAL ASSOCIATION.

The Canadian Electrical Association.

THE ninth convention of this Association, held in Hamilton last month, was in every respect equal, and in some important particulars in advance of any previous meeting. The attendance was above the average, and was representative of the entire Dominion, from Charlottetown in the east to Vancouver in the west. The headquarters of the Association was the New Royal Hotel, which has recently been remodelled and fitted up in a style of elegance not surpassed by any hotel in Canada. The weather after the first day was all that could be desired, and permitted full enjoyment of the excursions to various points of interest in the locality. The greatest credit is due to the local electrical companies and the City Council for the many courtesies extended to the visitors, and also for the attractive manner in which the public buildings and parks were illuminated. On every hand there was manifest a desire to make the occasion one of the greatest interest and pleasure, and this desire was in the highest degree fulfilled. Hamilton on this occasion proved her right to the title of the Ambitious City, and also to claim the new title of the "Electrical City," in consequence of being the terminus of the Cataract Power Company's lines, which, as Mayor Teetzel mentioned in his address of welcome, transmit a larger amount of current over a longer distance than is delivered to any other city east of the Mississippi river. In the Hamilton, Grimsby & Beamsville Electric Railway, the city has also the longest suburban electric railway in the Dominion. Coming back to the convention, it can be stated that the business sessions were marked by a deeper interest than on previous occasions. The value of the papers presented is evidenced by the pointed and lengthy discussions. There was a time in the history of the Association when it was a difficult matter to provoke discussion, and when papers had in a measure to be taken as read, because of the timidity of members in giving expression to their opinions. That time has now gone by. The electrical iudustry has, during the lifetime of the Association, made rapid advancement, and members of the Association have kept pace with the development of the industry and feel their ability to express their views, based upon their experience on subjects arising for discussion. It is unfortunate that time would not permit of the reading and discussion of all papers prepared for this convention, and it will no doubt be found necessary for the future to restrict to a greater extent than formerly the number of papers, and to exercise the greatest care in the selection of subjects, in order that the discussions may bring out information of the greatest value. One of the most important points brought out in the discussions was relative to the supplying of current for power purposes to manufacturers during the hours of least demand for current for lighting. Mr. Gossler made the important declaration that in Montreal the day load for power purposes has reached 75 per cent. of the night load for lighting, and that in a very short time it is expected the day and night loads will be equalized. The valuable work done by the Legislation Committee in having the Conmee Bill placed on the Statute Books of Ontario was appropriately recognized. There was a disposition shown to make greater use of the Association to further in a practical way the interests of all branches of the electrical industry. Mr. W. H. Browne made an excellent presiding officer, and contributed from a large personal experience much valuable information to the subjects under discussion. Mr. A. A. Dion, the President-elect, has been for several years one of the most active and useful members of the Association. Under his direction, and assisted by an excellent staff of associates, the prosperity and usefulness of the organization must continue to advance. The city of Ottawa was unanimously selected as the place of next meeting. Many members of the Association have pleasant recollections of the convention held in that city five years ago, and the success achieved on that occasion is the best possible guarantee that the next convention will be one of the highest interest.

The Chambers Electric Co., Truro, N.S., are taking out two of their return tubular boilers, replacing them with a 150 horse power "Mumford Improved" boiler, manufactured by the Robb Engineering Co.

CANADIAN ELECTRICAL ASSOCIATION

PROCEEDINGS OF THE NINTH CONVENTION

THE Ninth Convention of the Canadian Electrical Association was held in the New Royal Hotel in the City of Hamilton, Ont., on Wednesday, Thursday and Friday, June 28th, 29th and 30th, 1899.

The opening session was held on Wednesday at 2 o'clock p.m., the President, Mr. W. H. Browne, of Montreal, occupying the chair.

The following members were registered as being in attendance

J. A. Kammerer, J. J. Wright, A. E. Payne, E. B. Biggar, A. B. Smith, C. H. Mortimer, A. P. Horner, J. J. Ashworth, J. W. Campbell, T. R. Rosebrugh, A. Esling, A. M. Wickens, A. C. McDonald, Geo. F. Haworth, W. H. Warrington, A. D. McArthur, Joseph Rogers, W. McCaffrey, J. Milne, Ed. McCormack, Toronto; P. G. Gossler, John Carroll, Wm. H. Browne, Alex. Barrie, W. J. Plews, F. H. Leonard, jr., C. H. Wright, Geo. H. Olney, D. W. McLaren, H. C. Ross, R. E. T. Pringle, Fred. Thomson, P. H. Hart, H. G. McLaren, C. A. Woolsley, E. A. Wallberg, Wm. T. Bonner, W. E. Gower, Montreal; Geo. Black, W. A. Turbayne, Gordon J. Henderson, W. G. Angus, E. Irving, F. W. Martin, H. R. Leyden, J. B. Griffith, A. J. Nelles, C. K. Green, H. W. Woodman, Hamilton; A. A. Dion, C. Thomson, W. Ahearn, jr., John Murphy, D. R. Street, W. W. Grant, Ormond Higman, Ottawa; E. E. Cary, G. A. Powell, D. H. Henderson, J. Sangster, St. Catharines, Ont.; J. E. Bilger, W. F. Green, Berlin, Ont.; Geo. W. Shand, W. Williams, Sarnia, Ont.; J. F. H. Wyse, C. H. Waterous, Brantford, Ont.; John E. Gayfer, Stephen Noxon, Ingersoll, Ont.; B. F. Reesor, Geo. Sadler, Lindsay, Ont.; A. A. Wright, W. H. Mackay, Renfrew, Ont.; John Yule, Guelph, Ont.; H. O. Fisk, Peterboro, Ont.; Geo. C. Hinton, Vancouver, B.C.; P. H. Hover, New York City; S. E. Fletcher, St. Johns, Que.; J. W. Purcell, Walkerville, Ont.; A. Sangster, Sherbrooke, Que.; L. A. Somers, Halifax, N.S.; Mark B. Thomas, Dundas, Ont.; James Anderson, Windsor, Ont.; John Phillip, Grand Valley, Ont.; J. Wardell, Charlottetown, P.E.I.

The President: Gentlemen, it is our pleasure to have our ninth convention opened by His Honor, the Mayor of the City of Hamilton, who was formerly connected with our industry and is here to offer us the courtesy of the city—His Honor, Mayor Teetzel. (Applause.)

Mayor Teetzel then addressed the convention as follows:

Mr. President and Gentlemen: It affords me great pleasure on behalf of the city of Hamilton to welcome you to our city, and in doing so I do not think a more hearty welcome could be extended to any body of men than to the Canadian Electrical Association. I understand you did us the honor of holding your first convention here in 1892. Since that time great strides have been made in electrical discovery and invention. We are pleased especially at this period to welcome this Association here, for we feel in Hamilton almost as though perfection and completion of electric discovery had been attained; that is the way it would appear to novices; it would appear that it is almost impossible for further improvement to be made in electrical discovery and invention. We feel at the present time in Hamilton very proud of our position in connection with the science of electricity. We have, I believe, been christened the "electric city" by one of your periodicals, at any rate. We appreciate that suggestion, and I think it shall go forth from now on, that Hamilton is the electric city of Canada at any rate. (Applause.) We may not be—I trust we will not be—considered egotistical or conceited by claiming that we are the first city in Ontario, as far as electricity and the enterprises and developments that have been brought about in this particular science is concerned. There is no city, I understand, east of the Mississippi river to which so much power for such a great distance is conveyed as to the city of Hamilton. That is a distinction we are justly proud of. I understand there are cities west of the Mississippi that have conveyed to them for greater distances as much or greater power than we have in Hamilton, but I am credibly informed that there is no city on the continent east of the Mississippi river to which as much electrical energy is conveyed from such a distance as is conveyed to the city of Hamilton; and I am delighted to say, sir, that it is to be credited to the enterprise and courage of the citizens of Hamilton that this result has been brought about. We also, I believe, have the proud distinction of being the first city in Ontario that adopted the arc light for public lighting by electricity. I believe Montreal was in advance of us, but if I am correctly informed, Hamilton was the first city in Ontario that took that departure, and I had the pleasure of being a member of the city council in the latter part of 1884 and the beginning of 1885 when that innovation was inaugurated, and I have never ceased to compliment the efforts of myself and the other members of the council to have inaugurated in Hamilton the system of arc lighting. I also believe Hamilton is the first city that had in actual operation, in Ontario at least, the electric railway system. I do not suppose you expect a speech from me to-day. I have been honored by an invitation to be present at your banquet to-morrow night, and I may have a few further remarks to make on that occasion. But I will say that in welcoming this Association to Hamilton, I do so, as I said before, most heartily; I believe I could not welcome any Association of gentlemen more heartily, because I look upon the devotees of electrical science as a combination of men who have done more during the last quarter of a century to advance commerce, industry and civilization than any other body of men the world over. You have so reduced the size of the world. True, before the beginning of the last quarter of a century the size had been reduced, but during the last twenty-five years, by the application of electrical current to power, and by the telephone, communities have been brought together, industry has been stimulated, commerce has been advanced, and civilization has been advanced in consequence; and I am proud to say also in that connection that to the names of Canadians perhaps to more than any other names can be attributed much of this great accomplishment. Edison and Bell and scores of other Canadians following down the line—the Thomsons, the Wrights, the Leydens, the Brownes, (applause) and a horde of other electricians, have contributed their quota to the perfection of the science. Gentlemen, I say nothing further on the present occasion than to repeat the welcome I have made, and I trust your stay in Hamilton may be pleasant and profitable. I am sure that our electrical friends here will do all they can to entertain you hospitably; if they do not, I ask you to make any complaint to me, and I will endeavor to see any grievance properly adjusted. In the meantime, so far as I have the power and up till ten o'clock on each night, so long as you remain under the charge of my friends Leyden, Kammerer, Henderson, and my friend Wright, of Toronto, you shall have the freedom of the city of Hamilton (applause); and if you should be so bold as to stray beyond their protection

that freedom will be withdrawn—not that I feel that you of your own inclination would go astray, but you might fall into the hands of those who might attempt to lead you astray. I again repeat, I wish you may have a very profitable and pleasant session, and that your deliberations will result in great good and in great profit to yourselves and to the advancement of the science to which you are devoted. (Applause).

The President: I will call upon our ex-President, Mr. Yule, to express the thanks of the Association to His Honor, Mayor Teetzel, for his kindly welcome.

Mr. Yule: I have much pleasure, Mr. Mayor, in tendering you the thanks of this Association for your hearty welcome, and I can guarantee the good behavior of all the members of our Association. I do not think it will be necessary for you to give any private intimation to the Chief of Police to see that we all get home in good time. We thank you most heartily for your kindly welcome, and we will do our best to enjoy ourselves while in the city of Hamilton.

President Browne addressed the convention as follows:

PRESIDENT'S ADDRESS.

GENTLEMEN:—Although in the declaration by the Constitution and By-laws of the general order of business to be followed, no place or time has been allotted nor provision made for such a procedure, yet it appears by the programme of events that the Committee have appointed that the convention, like the eight preceding it, shall begin with a President's address.

I would prefer to be governed by the prescribed formula of the Constitution, but as tradition and unwritten law frequently exert more control than written law, I must endeavor to emulate the good example given by my predecessors even if unable to hope to do more than emphasize by contrast the paucity of the suggestions which I may offer.

I will not undertake to occupy much of your time, because the committee have provided for our consideration a goodly array of good things. You will receive and hear read the reports of the several committees, and also that of the worthy Secretary-Treasurer recounting the condition and progress of the Association during the past year; and you will hear and discuss several very excellent papers when you find opportunity between the various events of hospitality provided in such prodigality by the local committee.

You will be particularly gratified by the report of the Committee on Legislation, through whose efforts was achieved the passage at the last session by the Ontario Legislature of an eminently just enactment having to do with the relations between municipalities and electric companies. The report of that committee will be accompanied by a copy of the enactment referred to, from which you will find that both municipalities and existing electric lighting interests are protected from unwise and hasty investment on the one hand, and from constantly impending danger of threatened annihilation of existing investments on the other hand.

The ninth convention of this Association is very appropriately held in the city where its first convention took place. Nowhere else could the extraordinary and rapid progress of electrical development be more emphatically demonstrated, nor the contrast with conditions existing only seven years ago be so sharply defined, than in this city of Hamilton. For here is tangible evidence in active daily operation of the furthermost advancement of the electrical art of to-day, in the distribution of the potential energy of Lake Erie throughout the city, dispelling its darkness and operating the machinery of its manufacturers.

At the first convention of this Association, held in this city only seven years ago, the probability of such a practical, commercially successful demonstration was considered to be in the far and remote future, as appears from the record of that convention. The transmission of energy a distance of thirty odd miles, as is the case here in Hamilton, was looked at doubtfully both from a physical and commercial standpoint. To-day no doubt exists as to the physical capability of transmitting and manipulating electric currents of high potentials long distances, for the varied uses of light, power, heating, chemistry and metallurgy.

The question no longer is, "Can we apply the electric current to this and to that purpose?" but "What new fields of enterprise can it enter and develop?"

This transformation in Hamilton took place shortly after the conclusion of the convention last year in Montreal. Since that time also has been put into operation a plant at Rossland, British Columbia, transmitting about the same amount of power the same distance as here. Many of you last year visited the works at Chambly, then under construction for the transmission of current to Montreal, and it is my pleasure to announce that the electric current has been transmitted from the power house on the Richelieu river, and the waters of Lake Champlain transformed into electric energy, flow throughout the city of Montreal. Such enterprises are so much the accepted fact and indicate successful physical accomplishment so thoroughly that many other similar enterprises, covering even greater distances, are being seriously considered by conservative capitalists, keen to perceive the great commercial advantages that will accrue from the developments made in this field of electric science.

Arising from the increased uses of water powers for the generation of electric energy, and the successful application of such energy to commercial motive power uses, a condition is beginning to assume shape with every indication of increasing, which may modify existing manufacturing conditions and perhaps change habits and methods of living. Its general adoption will result in the cheapening of motive power for manufacturers as well as reduce their costs otherwise, and also cheapen electric current for lighting.

I refer to the limitation of the use of electric current for manufacturers' motive power to the hours of daylight, or perhaps more properly speaking, to the time outside of those hours when the need of illumination makes the greatest demand upon the electric plant. A considerable objection to undertaking to seek motive power business has been the necessity of increased capital for plant in excess of lighting requirements to take care of the load which would exist during the hours when the motive power load and the lighting load would be called for simultaneously.

The idea has been maintained and acted upon that it is profitable for many, if not all manufacturers, to discontinue work as soon as the dark hours begin, for the reason that the cost of manufacturing is increased during such dark hours by the necessity of expense for illumination and by the diminished productive capability of the operatives. Besides avoiding these increased expenses, manufacturers can obtain the use of electric current for power, at a considerable reduction in price outside of the hours in which the greatest demand necessarily occurs for lighting. The cost of motive power to the manufacturer can be thus made much cheaper than he could otherwise produce it.

This additional source of revenue or increased return upon capital investment for plant and lines, will also enable the generator and distributor of electric current to sell such current for lighting profitably, at a less rate than when no revenue is derived from the plant in the day time. Less price for lighting will assist materially in the increased use of electric current for illuminating purposes. Since this idea was first suggested it has grown considerably, and its application is being gradually extended, and it does not seem too much to say that in a few years the hours of manufacturing will be restricted to the hours of daylight, with all the advantages that will result therefrom. While this condition is of the most value to the water power generation of electric current, it is of great value also to steam generation plant, by reason of the increased return upon invested capital which it will provide. The suggestion is well worth thoughtful consideration and furtherance.

In another direction also, the assembling of our convention in this city demonstrates the progress that has been made since the commencement of the career of the Association. At the first convention there were present 57 active and 24 associate members The total membership of the Association, by the report of the Secretary-Treasurer at the present time, is 241. This increase, continuous and progressive from the first convention, indicates not only lively and hearty appreciation of the advantages to be derived from association for mutual intercourse and improvement of knowledge from interchange of ideas, but also denotes continuous growth of electric interests and the progressive development of new enterprises.

Surveying the entire field of electrical industry in Canada to-day, it may be fairly said that if all are not in thoroughly sound and healthy condition, the greater number of them are prosperous and improving. In the days of the first convention, this could not be so well said, for as many of you, no doubt, remember, conditions were precarious and the probability of success uncertain. Here again I may allude to the result recently accomplished by our Committee on Legislation, which will greatly tend to advance such prosperity. Already it has had the effect of strengthening and fortifying existing enterprises, encouraging owners to endeavor to extend and increase their business, to enlarge and better their plants, because now they feel assurance that their investments are protected and that they cannot be deprived of them ruthlessly and recklessly. This is as it should be, not only from the point of view of the private owners of such enterprises, but from that of the general public and municipal interests.

Notwithstanding that the legislation referred to is so eminently fair, just and equitable, both to municipalities and to private interests, yet it is incumbent upon the members of this Association and upon all those having interest in electrical enterprises, to adopt systematic, prudential means of preventing retograde action in such legislation which may be aroused and agitated by persons of narrow and restricted views, who may undertake to procure alterations of the legislation referred to. It seems proper to suggest that all present members become actively interested to procure additional members for this Association throughout the Dominion; thereby to strengthen its capability for useful effort so that by unity of action procurable through the efforts of such enlarged organization, not only may the meritorious conditions obtained in this province of Ontario be maintained, but also be extended to the other provinces. To that end it is respectfully urged that every present member endeavor to add to the membership of this Association, thus to fortify and strengthen our committees in the furtherance of their efforts for the proper benefits that should accrue to capital invested in all electric enterprises.

The value of concerted action for mutual information and advantage may be illustrated in another direction by the following:

Many persons interested in electric lighting were solicitous as to the possible invasion of their business by acetylene. For the purpose of assembling authentic information as to the progress, present status and use of acetylene for domestic and commercial illumination, a circular was sent to cities, towns and villages throughout Canada having electric plants, requesting exact statements as to the conditions existing in those localities concerning its use and its interference with electric lighting. Replies were received from 103 localities. The results have been tabulated, and with some extracts from newspapers, will be presented in the proceedings of the convention so that every member will have accessible the fullest and latest information on that subject in convenient form. Here it seems sufficient to say that it may be concluded that no serious menace for the present, at least, need be anticipated therefrom to the electric lighting industry, although undoubtedly useful and profitable fields will be found for the desirable and proper use of acetylene.

The papers which will be presented and read at this convention will treat of matters of the highest practical importance, and I will not undertake to detain you longer from their consideration and discussion. They are of such character as to possess acute interest for all, and I solicit for them thorough and complete discussion to bring out any points not touched upon by the writers. The subjects selected are the results of suggestions received from many members in response to circular communication sent to the members some months since, and, therefore, may be considered to be your own selections.

With reference to these papers, on behalf of the committee having this matter in charge, I wish to say that they are particularly grateful to the writers who have accepted the requests of the committee It is not always convenient, and probably it may be said, it is never convenient for a busy man especially (and it would seem as if most of us in

this business are always busy), to find the necessary time to devote the concentration and thought necessary to the preparation of a paper that each writer considers he should, with justice to the Association and to himself, present for consideration.

I desire to express my regret at having been unable to devote as much time to the affairs of the Association as I should wish to have been able to do, but my regret is materially modified because the gentlemen of the various committees have so thoroughly attended to the matters entrusted to them, that the interests of the Association could not in any wise suffer by want of attention on my part. I therefore wish to extend my earnest thanks to the officers and members of committees associated with me, for their hearty co-operation, and to thank you, gentlemen of the Association, for the honor so cordially bestowed upon me in electing me president, and to bespeak for my successor the continuance of such hearty co-operation and enthusiastic support.

The address of the President was greeted with loud and prolonged applause.

The Secretary, Mr. C. H. Mortimer, read the minutes of the last annual convention, which were approved and adopted as read, as was also his annual report, as follows :

SECRETARY-TREASURER'S REPORT.

The most important work to engage the attention of the Association since last convention was the effort made, under the immediate direction of the Legislative Committee, to have such amendments made to the Municipal Act as would prevent the confiscation by municipalities of private capital invested in the electric lighting industry. It is gratifying to be able to report the success of the movement, which involved many meetings and much effort on the part of the committee and those associated with them. Particulars of this important work, which serves to establish the practical utility and usefulness of this Association as a means whereby the interests of its members may be conserved, are contained in the report of the Chairman of the Legislative Committee to the Association at this convention. It will no doubt be deemed advisable to provide means for safeguarding the rights which have been secured to electric lighting companies by the Conmee Bill.

The Executive Committee held three meetings during the year. At the first of these, held on September 9th, accounts in connection with last convention, amounting to $240, were passed ; the additional sum of $50 was granted to assist the Entertainment Committee to discharge its obligations ; the resignation of one member was accepted, and one new member was elected.

On March 23rd, the committee met to consider arrangements for this convention, and other business; a committee was appointed to make the necessary local arrangements, consisting of Messrs. George Black, H. R. Leyden, Gordon J. Henderson, E. E. Cary, Wilfred Phillips, A. B. Smith, together with the following gentlemen as honorary members: Messrs. Clyde Green, J. A. Nelles, Mark B. Thomas, J. B. Griffith, with power to add to their number. A committee to arrange for convention papers was appointed as follows : The President, Messrs. E. E. Cary, A. A. Dion, J. J. Wright, John Carroll, and the Secretary. Messrs. Cary and the Secretary were appointed a committee to procure badges and buttons for the use of officers and members attending the convention. The sum of $100 was voted to the Local Committee for entertainment purposes. The Secretary was directed to send out accounts to members for overdue fees, and to notify them that the names of members in arrears on the 1st of May would be struck from the roll. The Secretary was empowered to obtain the services of an assistant during the convention. Four persons were elected to active membership.

On the 20th of May, the committee met to receive the reports of the various sub-committees, and to complete arrangements for the convention. Five resignations were accepted, and two members elected. Accounts for convention buttons and printing, $23.05, were passed.

The number of new members elected since last report is as follows : Active, 20 ; associate, 2 ; total 22. During the same period there have been removed from the roll 14 active and 1 associate, leaving the present membership 241, or a gain of 7 over last report.

Several members in arrears for fees have objected to make payment, on the ground that they joined the Association for one year only. It should be clearly understood that when a person joins the Association, he is to be regarded as being a member until his formal resignation is placed with the Secretary. I would respectfully suggest that the form of application for membership be altered so as to conform to this view.

The receipts and disbursements have been as follows :

FINANCIAL REPORT FROM JUNE 1ST, 1898, TO 31ST MAY, 1899.

RECEIPTS.

Cash in bank, June 1st, 1898	$281.18	
Cash on hand, June 1st, 1898	19.46	
151 active members' fees at $3	453.00	
1 active member's fee at $3—paid $2	2.00	
22 associate members' fees at $2	44.00	
		$799.64

DISBURSEMENTS.

Expenses of convention		$435.14
Grant to local committee	$200.00	
E. J. Jenkins, stenographer	40.00	
Martel-Stewart (show cards)	5.00	
Convention buttons for 1898	64.64	
Electrical News, printing account	101.50	
Cuts for convention paper, and duty on cuts	20.49	
Express on parcels	2.08	
Telegrams	1.43	
	$435.14	
Grant to Secretary	$125.00	
Postage	46.18	
Express charges	.26	
Letter file	.40	
Telegrams	1.00	
Exchange on cheques	3.60	
Stationary and printing	19.95	
Buttons and badges for 1899	12.50	
Balance in bank	137.76	
Balance on hand	17.85	
		$799.64

RECEIPTS SINCE MAY 31ST, 1899.

Cash in bank, June 1st, 1899	$137.76	
Cash on hand, June 1st, 1899	17.85	
52 active members' fees at $3	156.00	
5 associate members' fees at $2	10.00	
		$321.61

DISBURSEMENTS.

Postage	$ 12.30	
Exchange on cheques	1.65	
Stationery	.55	
Cash in bank, June 27th, 1899	296.76	
Cash on hand, June 27th, 1899	10.35	
		$321.61

We have audited the Treasurer's account and find same to be correct.

H. R. LEYDEN.
GEO. BLACK.

The President : The next order of business is the reports of committees. I will call for the report of the Committee on Legislation first, and ask the Chairman, Mr. Yule, to read it.

REPORT OF COMMITTEE ON LEGISLATION.

Your Committee on Legislation beg leave to report that in compliance with motion passed at convention held at Montreal a year ago instructing them to continue their efforts to secure legislation in Ontario, the better to regulate the relations between electric light companies and municipalities, where the latter desired to enter upon municipal lighting, arrangements were made for the purpose of a united effort to put before the legislature the justice and merits of our views and the injustice of the law as it then stood.

A Bill was prepared by counsel, and after being submitted to your committee, was brought before the House, the result being, as you all know, that an Act was passed extending the provisions of the law regarding waterworks to lighting companies, providing for the transfer, upon fair conditions, of lighting plants to corporations, when they decide to enter upon the business of supplying electric light, and otherwise regulating the relations between municipalities and lighting companies on equitable terms.

Your committee held numerous meetings and gave the matter careful attention until what is now known as the "Conmee Bill" passed the legislature.

Your Committee do not intend, in this report, going into the details of their labor, but think it proper to inform you that the objections that had to be met and answered were of a popular and plausible nature and calculated to prejudice the minds of members until they fully understood the merits of the question.

The obstacles in the way of the Bill were increased by the hostile attitude of some of the newspapers, although the Committee are pleased to say that as the Bill became better understood, it received better treatment at the hands of the press.

Mr. James Conmee, M.P.P., West Algoma, took charge of the Bill, and the result proved it could not have fallen into abler hands. It only required a short time to convince your Committee that Mr. Conmee was fully alive to the justice of the general principle we were contending for. He had a practical knowledge of the merits of the questions at issue and the difficulties surrounding them. And what was of equal importance to us was that Mr. Conmee proved his ability to clearly, forcibly and intelligently explain the measure to his fellow members and to the House.

Mr. Conmee also introduced into the Bill, with your Committee's concurrence, various provisions to adopt such suggestions as were of value and which he considered were salutary amendments in the public interest.

Your Committee admired the patience and tact with which Mr. Conmee, on different occasions, met and discussed the matter with them and also with the opponents of the bill.

Your Committee retained, as parliamentary counsel for the Bill, Mr. Donald Guthrie, Q.C., Guelph, who drafted the Bill, and during the progress of the work he was assisted by Mr. W. D. McPherson and Mr. Edward Bayly, barristers, Toronto, Mr. Gauld, barrister, Hamilton, and Mr. Pepler, of Barrie. The measure was also supported by a number of legal gentlemen retained by different lighting companies ; influential deputations from different parts of the province also attended in Toronto to assist your Committee.

The arduous and exacting work for quite a time, when the outlook was very unpromising, added largely to the expenses of your Committee, but they are pleased to be able to say that all accounts have been paid in full.

About fifty companies contributed to the expense fund, a statement of which is appended. In this connection your Committee desire to convey to the Royal Electric Company, Montreal, and

the Packard Electric Company, St. Catharines, their hearty thanks for unsolicited and substantial contributions received from them.

The management of these companies recognized in a practical form that the stability of the lighting companies was of vital interest to them.

Before passing from the Conmee Bill your Committee desire to point out two important provisions in that Act:

First—The clause providing for corporations having the right to get contract price for street lighting fixed bv arbitration, where parties fail to agree, thus removing the complaint that lighting companies could make municipalities pay an unreasonable price because of there being no competition.

Second—The provision made for having prices charged to citizens fixed in the same manner. These clauses very materially extend the powers and rights of municipalities.

At the last meeting of your Committee the policy to be recommended to our successors in office was discussed, and it appeared to be the opinion that while there was no probability of the principle of the "Conmee Bill" being repealed, there may be efforts made to get amendments passed that would endanger the fair working of the Act.

They would respectfully recommend that some arrangement should be made to give attention to all measures introduced in which lighting companies are interested.

For this purpose, your Committee consider it would be an economical policy for the companies to enter into an agreement, for say five years, to pay a small annual subscription to cover the expense of legal services for this purpose. The reason for suggesting the term of years is, that spasmodic and hurried efforts to raise necessary funds use up too much time and attention of your officials and members of Committee.

The members of this Committee, and in fact of all Committees, pay their own travelling and other expenses, and are of opinion thatthe lighting companies should not hesitate to provide them with the necessary funds to cover cost of services that have to be paid for and that are required in matters of this kind.

The foregoing is merely an expression of opinion on the part of your Committee, the result of two years' experience in actively attending to the interests of lighting companies.

JOHN YULE,
Chairman Committee on Legislation.

Dated 28th June, 1899.

ABSTRACT OF FINANCIAL STATEMENT.

Balance from 1897-98	$ 147.44
Subscriptions paid 1899	1,955.00
Total	$2,102.44
Paid for legal services	$1,854.87
Paid for office assistance, telegrams and telegraph messages, postage, stationery, printing and exchange on drafts	171.90
Balance on hand	75.67
Total	$2,102.44

The following were the contributors to the expense fund for 1899: Royal Electric Company, Montreal; Packard Electric Company, St. Catharines; W. A. MacKay, Renfrew; A. A. Wright, Renfrew; Arnprior Electric Light & Power Company; Brockville Light & Power Company; Smiths Falls Electric Light Company; Lindsay Light, Heat & Power Company; Owen Sound Electric & Illuminating Company; Bowmanville Electric Light Company; R. A. Corbett, Port Hope; Guelph Light & Power Company; Ottawa Electric Company; Sarnia Gas Company; Galt Gas Company; Cataract Power Company, Hamilton; Almonte Electric Light Company; Pembroke Electric Company; St. Thomas Gas Company; St. Catharines Electric Light Company; London Electric Company; Exeter Electric Light & Power Company; Strathroy Electric Company; Joseph Knox, Stayner; O. Higman, Ottawa; John Phillip, Grand Valley; Welland Electric Light Company; Willson & Sons, Meaford; A. M. Merkley, Morrisburg; Wm. Snider, Waterloo; R. P. Bearman, Chesley; Midland Electric Company; Perth Electric Light Company; Aylmer Electric Company; Toronto Electric Light Company; Madill Bros., Lakefield; L. H. Reesor, St. Marys; Parry Sound Electric Light Company; Hamilton & Prout, Forrest; Stormont Electric Light Company, Cornwall; Gananoque Electric Light Company; Citizens' Telephone & Electric Company, Rat Portage; Corley & Collins, Mount Forest; Gravenhurst Electric Light Company; J. A. Spence, Colborne; Robertson, Rowland & Company, Walkerton; Berlin Gas Company; Cobourg Electric Light & Power Company; Isaac P. Wiser, Prescott; Wingham Electric Light Company; Woodstock Electric Light Company.

The amounts contributed were as follows:

1	contributor paid	$250
2	" " $200 each	400
5	" " $100 "	500
1	" "	75
5	" " $50 each	250
1	" "	30
7	" " $25 each	175
3	" " $20 "	60
4	" " $15 "	60
9	" " $10 "	90
13	" " $ 5 "	65
	Total	$1,955

Mr. A. A. Dion: I have much pleasure in moving that the report which has just been read be received, and that the thanks of this Association be tendered to Mr. John Yule and the members of the Legislative Committee. The amount of work performed by these men during the last two years in connection with the legislation which has been obtained has been enormous, and their zeal is beyond all praise. The manner in which they handled this question calls for congratulation from the members of this Association, and certainly we cannot say too much in thanks and gratefulness for their devotion to a question which affects our best interests, and in obtaining legislation which will be a lasting benefit to the members of this Association.

Mr. J. W. Purcell: I take pleasure in seconding that motion. I think with Mr. Dion that the Legislative Committee have had a great deal of work which the members know nothing of, and they have had more work than it was thought they would have at the time they were appointed.

The President: I am in hearty accord with the motion which has been regularly moved and seconded, and before I put it I would like to hear expressions of opinion from any other members of the Association here. I think it is entirely due to the committee that as many members of the Association present as possible should, in their own way, express their commendation of the efforts and of the result of the efforts of this committee. There will be, undoubtedly, proper time to-morrow to consider and discuss the main suggestion of this report—that is, the agreement on the part of the companies in the Association or out of it to organize for a period of years and to agree to pay a small sum annually towards meeting the necessary expenses of this committee. I will be pleased now to hear any expressions of opinion.

Mr. H. R. Leyden: I want to say a few words in connection with this matter, and I want to express what I think ought to be the opinion of the Association in respect to Mr. Yule's personal connection with this. I know, from the small connection I had with this legislation, that Mr. Yule devoted the principal part of two months to this bill; and I also know that he was in Toronto for two whole weeks doing nothing else but working on this bill. There were also a number of other gentlemen, most of them members of the committee, who labored incessantly during the meeting of Parliament in Toronto to further this measure, and I do not think the members of this Association can go too far in any direction in expressing their gratitude to the members of this committee. I also think that the Association should, in some way, show their appreciation of the personal labors of Mr. Conmee in regard to this bill. I do not think I am going too far in saying that if it had not been for Mr. Conmee's personal energy that we would have had very grave difficulty in getting this bill passed. Mr. Conmee entered into this measure with all the enthusiasm of a man with a large amount of money invested in electrical interests; he took the greatest pains and the greatest patience in explaining the details and justice of the Bill to the different members. As far as the Bill itself is concerned, I think there is one point in particular that wants to be emphasized to the members of this Association, and that is the principle of arbitration which is now embodied in the electrical interests of Ontario. All public corporations in dealing with the public are subject to various unjust claims and demands. The electric lighting industry now is placed on a basis whereby through arbitration they can obtain what is right and fair, and on the other hand municipalities through arbitration can obtain what is right and fair. This principle of arbitration, by being applied to electrical interests, is going to do more, I think, for the interests of electrical companies in a fair way than anything else we could do. Just take an instance of it; this Bill provides specifically that in cases where the municipality and supply company cannot agree upon the price, that it shall be arbitrated; that arbitration will undoubtedly be on a fair basis and give the electric lighting company a fair return for their light. On the other hand, for private lighting, how much they shall charge is also to

be subject to arbitration. If the municipalities can obtain a fair service at a fair rate, there is no call for competition of any kind. There are a great many places, in England particularly, where this principle of arbitration is carried to such an extent that they give the illuminating company a certain territory and give them the exclusive right of lighting in that territory, the only provision being that they shall give a good service and at a reasonable rate, which rate is subject to arbitration. Now, if that principle of arbitration is carried to its proper extent, the electric lighting companies, as long as they do what is fair, will enter on an assured era of arbitration. That principle of arbitration, to my mind, is one of the most valuable features of that bill.

The President : Mr. Leyden has undoubtedly struck the key note of this entire legislation, that is, the principle that investors in any enterprise of a semi-public nature will be entirely satisfied with a fair and proper return upon their investment so long as they are assured of non-interference—so long as they can be assured that when they give fair service and fair rates their investment is secure, and that principle being established by this act of legislation, it would seem, as it were, utterly impossible, if we give the matter any attention at all, that it should ever be taken off the statute books. Now, gentlemen, the motion is before you, and I ask for your approval thereof.

The motion was carried amid applause.

The President : The next committee to be heard from is the committee having to do with the Board of Fire Underwriters ; I will ask Mr. Gossler to read the report.

Mr. P. G. Gossler read the report of the committee appointed to interview the Board of Fire Underwriters, as follows :

REPORT OF COMMITTEE TO INTERVIEW FIRE UNDERWRITERS.

To the President of the Canadian Electrical Association.

Your Committee, appointed at the convention of 1898 of this Association, for the purpose of interviewing the Quebec Board of Fire Underwriters with regard to the adoption of permanent rules governing electrical installations and means of enforcing compliance with the same, beg to report that they had several interviews with the secretary and with a special committee of the underwriters. The question of rules and inspection was thoroughly discussed, but no understanding towards the establishment by the underwriters of a regular and efficient system of inspection was arrived at. It was held by the underwriters that such a system of inspection, even if it covered only the principal cities of Canada, would involve a much larger expenditure than they felt called upon to undertake. They had provided rules for electrical installations, and they considered that the electric companies and the municipalities should in their own interest see that these rules are carried out. Your committee would recommend that a committee be appointed at this convention to continue the work, and endeavor to have established some efficient system of inspection, independent of and apart from the electric companies, for the protection of our own interests as well as those of the underwriters.

(Signed) P. G. Gossler.
A. A. Dion.

Mr. Gossler : in connection with this report I wish to say that while it is short and does not seem to have involved much labor, there has been considerable work done. I have, on several occasions, in company with Mr. Dion, of Ottawa, interviewed Mr. Hadrill, secretary of the Quebec Board of Fire Underwriters. They gave us no encouragement whatever to establish a system whereby the fire underwriters would be called upon to be at any expense ; they maintained that the proper way of establishing a system should be by municipalities enacting by-laws whereby the buildings and building laws would enforce compliance with the Board of Underwriters' rules as at present universally adopted. I may say that there was very little encouragement given to the committee at all, because the fire underwriters did not seem to think the fire hazards due to electric wiring were such as to warrant them going to any expense. We called to their attention the fact that the fire underwriters of other large cities had seen fit to go to this expense ; but I presume they thought they would profit by their own experience rather than offer any suggestion whatever for the establishment of an inspection system. I might say on this committee was Mr. George W. Sadler, of Montreal, who at the time of his appointment, was and is at present a member of the city council of Montreal. He is also a member of a special committee on building rules of Montreal, appointed with a view of having rules made by the council embodied in the building association rules, to enforce the established rules for electrical installations. Mr. Sadler is unable to be present, and wrote me a letter which he wished to have read in connection with this report, which is as follows:

Dear Sir : At the last moment I find it is impossible for me to attend the ninth convention of the Canadian Electrical Association. There is no doubt but you are prepared to make a report to the Convention of the doings of the committee to confer with the insurance and the city of Montreal re the wiring of buildings. My appointment on that Committee was largely owing to my position as a member of the City Council of Montreal. I would like to say that I have found it impossible to do anything in the matter since our last meeting, the reason being that a great deal of time has been consumed in getting amendments to the Charter, and nothing could be done in connection with the by-laws until the Charter had passed the Council. Since then the various committees have had the by-laws under consideration, but very little progress has been made. I stated at the last convention that the city of Montreal has a very good new building by-law prepared, and I had hoped to have it sent up for discussion in the council; this opportunity has not presented itself yet, and it may be a month or two before the committee will report to the council.

If the Convention decides to keep the committee on this subject standing, I will be very pleased to still act with them, and do all I can to further the interest of all concerned when the opportunity presents itself.

Please convey my kind regards to the officers of the Association, and I trust that the ninth Convention of the Electrical Association will be a profitable and pleasant one to all members.

Yours very truly,
Geo. W. Sadler.

Mr. A. A. Dion : Before any action is taken upon this report, as a member of that committee, I wish to refer to a matter which this report brings to mind—it is a fact that among the members of that committee was a man who was for many years a useful and active member of this Association, and who has been carried off by death since the last meeting of this Association. I think it is a duty, though a sad one, to register in the minutes of this meeting the regrets of the Association at the untimely death of Mr. F. H. Badger, jr.

The Secretary : In connection with the remarks just made by Mr. Dion, it will have been noticed that Captain Williams, who was electric light inspector for the London district, a respected member of this Association, and a respected citizen of the city of London, has passed away within the last two or three days.

The President : The regrets of the Association will be duly recorded in the minutes of the proceedings. In reference to the report of the committee just read, while the results achieved by them are not as successful as of the Committee on Legislation, it seems that they have begun in the right direction, and while the Board of Fire Underwriters may be obstinate, the very suggestion that some method can be adopted in building laws to procure the supervision by the proper authorities of the wiring seems to point to the fact that we may ultimately accomplish the same end, and I would suggest that the Association approve of the continuance of this committee in the hope that they may be able to have incorporated in the municipal laws the adoption of some uniform plan which will be final in its action.

On motion the report of the committee was approved.

The President called for the report of the Committee on Statistics.

Mr. J. A. Kammerer read the report of the Committee on Statistics, as follows :

REPORT OF COMMITTEE ON STATISTICS.

Gentlemen,—As chairman of the Statistical Committee, I beg to report that we have gathered a large quantity of information and data about the electrical industries in Canada, but have not been able to get quite all that we wanted. It was perhaps a mistake on the committee's part in starting out to make the scope of the report too wide, but I can assure you that when the report is presented it will be of some value. In view of this, I would ask that the Statistical Committee be continued for another year with the same personnel, or others whom you see fit to appoint. The data and information which we have gathered will be at their service.

Respectfully submitted,
(Signed) J. A. Kammerer,
Chairman Statistical Committee.

Mr. Kammerer : In connection with this report, I would like to say, Mr. President, that we found in all the data that we have got, especially as to prices of lighting, that our station managers seem to have the prices in a transitory stage—they are not settled. The

tendency seems to be that they want a little more money for what they are furnishing, and they are trying to find out which way they can make more ; and for that reason, more than any other, the report could not be completed. It would only be a half report, and I thought it best not to make a half report when, no doubt, we could make a full and complete one later.

On motion the report as read was approved.

The President called for the report of the Committee on Meter Inspection.

Mr. J. J. Wright : That committee has had no meetings during the past year. There have been no measures taken in regard to the inspection of meters by the government that would necessitate the calling together of the members of that committee.

The President : That would appear to be all the reports. The next order of business is General Business.

Mr. A. A. Dion : There may be no other opportunity of bringing up a question which is suggested by Mr. Wright's report, and it is this : We as a company in Ottawa propose to take up with the Inspection Department the question of the possibility of making such departmental regulations as would allow of meter seals being broken for cleaning and adjusting the meters without paying an extra fee. As the law is at present, you are aware that meters have to be inspected every five years. There are not a great many meters that will run for five years without some adjustment or cleaning, and this cannot be done under the present regulations without breaking the seal and paying an additional fee. I take it that the intention of the government is not to compel companies to pay for meter inspection more than once in five years for each meter in service ; therefore it is a proper question to ask them if some regulation cannot be made whereby the privilege of breaking seals will be allowed under certain restrictions. The question arises whether this Association should not take this matter up; possibly the Committee on Meter Inspection might be continued with the hope of taking this question up during the present year. I think it is one of considerable importance. The cost of meter inspection is quite a large item to some of the companies, and having to pay extra fees makes it still greater. Mr. Wright no doubt has had considerable experience in using meters in large numbers, and he can probably see the value of the suggestion.

The President : It appears that the programme of part of the proceedings to-morrow will be the election of the standing committees, which will undoubtedly result in the continuance of the committees that have been already approved of, and thus accomplish the purpose Mr. Dion has suggested. Under the head of general business I am desired to say on behalf of the manager of the Hamilton and Dundas railroad that at five o'clock this afternoon he will be pleased to give the pleasure of a trip on that road to any and all of the members of the Association who may desire to participate. I presume that you will be able to enjoy this and be back in sufficient time to also enjoy the trip arranged for this evening at half past seven, as appears by the programme, to Burlington Beach, by courtesy of the Hamilton Radial railway and the Hamilton street railway. Another topic of general business, the Executive Committee at its session this morning thought it advisable to endeavor to crystallize or make deliberate the action of the Association in making nominations for the officers for the incoming year. Without undertaking to in any way restrict the individual action of the members of the Association, but simply for the purpose of exercising a deliberation and offering suggestions, it was desired that I would appoint a nominating committee. The election, as you are aware does not take place until Friday, but I will now announce the nominating committee who will take the matter in hand and present for our consideration tomorrow the names of the gentlemen whom they offer for your suffrages on Friday morning. As I stated before, this will not prevent any and all members of the Association from making nominations on their own account in contradistinction to the nominations offered by the committee. I now appoint as the nominating committee Mr. Cary, Mr. Carroll, Mr. J. J. Wright, Mr. Yule and Mr. Wyse, and I commend to their kind and early consideration the adoption of a ticket that I trust will meet with the universal approval of the members and will not call for any opposing nominations.

Mr. John Yule: Do I understand that this committee will nominate the members of the standing committees?

The President : No; they will nominate the members of the Executive Committee, and the gentlemen up for the offices of president, first vice-president and second vice-president.

Mr. J. Yule : Hasn't it been the practice heretofore for the President to nominate a small committee to confer in the nomination of the standing committees ?

The President : That, I understand, is the action to be taken to-morrow. I may be incorrect about it, but there seems to be no provision made for any other method in the programme. I am entirely willing, Mr. Yule, to leave to this committee the selection of the standing committees for the year. If they are good enough to select the candidates for offices, they will be good enough to do that. I understand it is in the nature of an advisory board to the President in appointing the standing committees.

Mr. Yule : I think you will find the committee to nominate the standing committees was always nominated the first afternoon and reported the next day.

The President : Very well ; I will entrust that to this same committee.

Mr. J. J. Wright: When is this committee to report ?

The President : To-morrow ; preferably as early as possible.

The President read two communications, one from C. S. Cochran, photographer, and the other from Mr. G. A. Browne, traffic manager of the Richelieu & Ontario Navigation Company.

The President: Has any member anything of general business purpose to offer for consideration now ? (No response.) There being none, the next order of business is the presentation of papers. I will call upon Mr. A. A. Dion to read his paper entitled "Meters and Meter Rates." You all have copies. You will find it is exhaustive and enters into the question fully, and I hope and solicit most earnestly that, as the reading progresses, you will all make notes and bring up matters for discussion. Let us have all the papers fully discussed. I am sure that the writers of papers will feel no injury to their feelings whatever in having all sorts of discussion brought out in order to make clear to ourselves and perhaps to assist them in a further exposition of their subject.

Mr. A. A. Dion, of Ottawa, read his paper entitled "Meters and Meter Rates," which is printed on page 156.

The President: I think, gentlemen, that the Association can take exception to the last paragraph of Mr. Dion's paper in which he intimates that he has not treated satisfactorily this subject. I think in that we must disagree with him. But there is much in this paper which, while coinciding with the experience of many of us in almost every particular, ought to arouse a great amount, not of discussion in the sense that it may mean objection to what is said, but for the purpose of reinforcing what Mr. Dion has said in many particulars, and I think if I call upon Mr. Gossler, who is quite familiar with the system in Montreal and what our practice there is, it may assist in promoting further talk on the matter.

Mr. P. G. Gossler: Mr. President, before the convention comes to discuss that part of Mr. Dion's paper relating to meter rates, which I presume is by far the most interesting part of the paper to us all, there are several points in connection with testing meters which I should like to bring up for discussion for my own information. I first refer to that part of Mr. Dion's paper under the head of "meter room," where he says "The meters should be connected in series, and the circuit, which must be of large wire, should pass through a main switch and cutout, a rheostat or choking coil to adjust the voltage." It has been the result of our experience and some exhaustive tests to determine the

characteristics of the meters we have in use, mainly Schallenberger meters, that testing meters in series introduces an inductive load; that is, the coils of the meters themselves introduce a lagging current and there is an inductive load, and we find the meters run fast; consequently, the meters for proper adjustment will be adjusted to run slower. When I say they run fast, I mean when compared with what they will run on a non-inductive load such as a lamp load. This may not be detected if the meters are placed on customers' premises and then brought in and tested in the same way, but I am positive if Mr. Dion has placed his meters in series in testing them and adjusting them in series, with an extra inductive load, on a choking coil, that he will find them running considerably slower on the customers' premises. But if anyone else has had that same experience I would like to have it confirmed, because I have made rather a positive statement. There is another statement where Mr. Dion says that he has obtained very satisfactory results with only ordinary care with the Schallenberger meter. That has not been the result of our experience; we have found a great deal of care is necessary in all such meters. We found that merely placing the meter on the floor in a great many cases injured the steel pinion or pivot and also in many cases cracked the jewel. As to the statement that meters will not start with less than three per cent. of load, I am happy to say that day has gone by, because we have in use meters that will start with two-tenths of one per cent. of their load. I am confining my remarks now entirely to the testing of meters. The statement that meters will run slow on light loads is also modified by the results of our experience with meters and light loads. We have had two meters calibrated to run identical on three-quarters of the full load, and we have found one meter to run very slow on a quarter load, and the other meter to run possibly five per cent. fast on a quarter load, so that the registration of the meter under half load is entirely dependent upon the friction of the jewel. The number of lights that Mr. Dion has stated, that the Schallenberger meter will start upon, often applies to meters that are comparatively new, but after they have been in use for some time we find it takes a considerably larger number of lamps than is stated. I would like further to discuss the matter of meter rates when it comes up, but I will defer that until later.

The President : Mr. Gossler appears to agree with Mr. Dion that this subject should have been divided into two parts, for he has confined his remarks to the question of testing meters only. We will adopt the suggestion of the two gentlemen and ask for other remarks upon the matter of meters and meter testing before we take up the question of meter rates.

H. O. Fisk : I may say I have devoted considerable time to accounts of the recording watt meter, more especially of the old type. We have quite a number of meters that were made some years ago and we find they run slow under light loads, as has been stated by Mr. Dion. I have devoted considerable time to find if these meters could be brought up to date ; that is, made to run accurately on light loads ; and I find by putting an auxiliary coil to run with the field, that is, taking part of the shunt that acts as resistance in series with the armature and winding that so as to work with the field that it will increase it just enough, that is if the coil is proportioned right, to eliminate the friction. When you have arrived at that point your meter will run on a very light load ; in fact on a 50 light meter I have got 55 watts out of 60 ; that is not taking a master meter, but taking an indicating watt meter and a stop watch, and having the voltage and everything as perfect as it is possible to have it. We find it a great advantage to make an accurate record of all meters we put in, especially when they are new, and when they are tested. We do not test them just as the government prescribes ; we test them on one, two, three, five and ten lamps,—that is for an ordinary ten light meter,—and more for a larger meter. These tests are recorded and kept in a book. We find a customer will come in and kick about his meter being outrageous, and just by showing him this record that was made before the meter was sealed, it settles the whole trouble. We find it a very fine thing to keep a record of that kind. But, the auxiliary coil, as I mentioned before, for old meters, is a fine thing. Take a meter even with a dirty commutator, that auxiliary coil can be made to make that meter strong enough without cleaning the commutator.

J. F. H. Wyse : Don't you ever find that the auxiliary coil makes it run without any load on it.

Mr. Fisk : We put as much as 100 ohms of No. 30 wire right on the field and that adds to the resistance in series with the armature and also eliminates the friction. It not only works out in theory, but it is also borne out by practice. I have tried it.

A. A. Wright : Deriving our revenue almost entirely from meters, we ought know more about meters than we do. I quite agree with Mr. Dion that a meter room should be provided for the testing of these meters and cleaning them, and so on. There are one or two questions I would like to ask Mr. Dion. I don't exactly understand how he keeps his record. He says that there should be a day book and entries made in the day book, and these posted into the ledger. Providing, we will say, you are installing a meter in a house for Mr. Brown, what entry would you first make in the day book, and how would you enter it ?

Mr Dion : Mr. President, the entry in the day book would be a record of what was done—"the meter so-and-so, say 20 amperes, Schallenberger, installed at Mr. Brown's house, such a number, such a street." That will be the entry in the day book. Then supposing the meter was No. 20,515, he would turn to the page bearing the same number as the meter in the ledger. There will not be in the ledger a page numbered 20,515, but there will be a page headed with the same number as the serial number of that meter, and in that page you will enter that that particular meter was put in Mr. Brown's house. So that if you come across this particular meter a year after and you want to know the history of it, you turn to that page and you find it was tested on such a date and put in Mr. Brown's house ; it was taken out six months after and tested a second time and put in Mr. Smith's house, and so on ; the whole history of it will be there. The principal value of the entry is to show the different tests that have been made on that particular meter. It involves some work, but it is of some value.

A. A. Wright : Supposing you wanted to turn to meter No. 2,753, do you have an index ?

Mr. Dion : We have to have an index, or else enter your numbers in consecutive order.

Mr. A. A. Wright : You mention with reference to a man taking the readings when he goes around ; does the man that takes the readings put it right down in the book himself ?

Mr. Dion : No.

A. A. Wright : I know in our case, we have a book with the face of the meter right on it ; we have January, February, March and April on one side of the book, and then on the other side, right opposite, we have May, June, July, August, September, October, November and December; there are more months on one side than on the other. At the head of this, we have the name of the party, when his meter was installed, the style of the meter, the number of the meter and everything in connection with it, the day it was installed, and the number of lights that the customer has. We have for every month the meter right before us ; and when you are taking the reading, after the man has put down the location in the index, you can tell whether he is reading the meter correctly or not.

Mr. Dion : Do you mean he carries that book with him ?

Mr. A. A. Wright : He carries that book with him every month.

Mr. Dion : I don't think that would be practicable with us. The readers think their book is large enough as it is.

Mr. A. A. Wright : It is practicable enough ; if you have too large a book you can have a number of books.

P. G. Gossler : I think you will find with most meters that are used that the serial numbers of meters, especially the Schallenberger meter, are up in the several hundreds of thousands and you cannot index them, neither can you locate them by the man's name on whose premises they are placed, because they may be changed several times a year. We have invented a card catalogue, and find it very satisfactory.

A. A. Wright : I know nothing about the Schallenberger meter.

The President: The same idea will apply to any make of meter, because their numbers are increasing all the time, and indexing by the number of the meter will become somewhat difficult ; it is well enough in the case of a small number of meters. But the card system will locate any meter at any time, and the history of that meter may be recorded on the card catalogue as forming the ledger referred to by Mr. Dion. It takes the place of a page in a book in which you recite the number of the meter, the date on which you receive it, the date on which you test it, the date on which you placed it in the customer's premises, the date on which you removed it from the customer's premises, the date on which you test it again, and the day on which you place it in another customer's premises, and so on ; in other words, it is the life history of that meter.

A. A. Wright : I have no doubt that would be a very advantageous way to do it, and of course we are very thankful to receive pointers in that way. I quite agree with Mr. Dion with reference to the installing of small meters instead of large ones, that it is very much better to install them on the small than on the large side, because it works better to the station owner. He suggests the reading of meters once in three months. I don't know, I am sure, how it would work in some places ; I know it causes a good deal of work, but I have always been under the impression that reading them monthly is the better way ; it saves a great deal of trouble and you don't have such difficulty in collecting your bills. Sometimes your customers run away, sometimes the bill gets too large, and I think monthly reading is the better way.

Mr. Fisk : In regard to the number business, we find the serial numbers change with some manufacturers. For instance, they will come out with a meter No. 650 Type F ; after a while another meter, 650 Type J, or something else. To get over that difficulty we started with our own local number, started with No. 1, and worked up, and we found it simplified things very much.

Mr. A. A. Wright : I suppose this matter of station meters could not be worked where you run both on meter and on flat rate.

Mr. Dion : Mr. President, I might say that I would take the station meter to be of special value in a case of that kind. I would compare the output of the station as recorded on that meter with the aggregate consumption as recorded in the consumer's meter ; the difference would represent waste ; and you could determine on that whether you were getting enough for your flat rates or not.

Mr. Wyse : I would like to ask Mr. Dion if he has adopted the method of having blanks, and having the man that would otherwise read the meter simply mark the location of the hands on those blanks, showing the location of the hands on the dial ?

Mr. Dion : Yes. The man has a book and each space contains about four cards ; each card is a facsimile of the meter dial, and he takes his pencil and writes the man's name and puts three or four strokes indicating the position of the different pointers.

Mr. Wyse : We make the bill out in the office and give the man those slips in duplicate, one of which he leaves with the customer showing the indication of the hands, and the other one he turns into the office, also showing the indication of the hands on the dial.

A. A. Wright : How do you keep account of these in your office so that at any time you can refer to them ?

Mr. Dion : The book is made of such a size that it will last about one reading. We employ two men reading the meters and there are four books ; each man takes a book, say, to-day, and he leaves it in the office the day following, so that the records may be transcribed from the books, and when they are through with that reading the books are about filled, and they are filed away, and a new set of books taken out next time.

A. A. Wright : I have never seen anything to equal the system I use myself. We find no difficulty whatever in having the whole month, every man's reading, right in the book, and you can see everything about his meter reading any time you want to let him see what every month's consumption amounts to and all about it.

Mr. Dion : How much room in a book would one customer take ?

A. A. Wright : Two pages to one customer.

Mr. Dion : We have over 3,000 meters ; that would be 6,000 pages.

A. A. Wright : One man couldn't do all that work ; you would have to have several books, one for each reader.

Mr. Dion : Each reader has to have a complete list unless you divide your city into districts.

A. A. Wright : Certainly.

The President : With the Royal Electric Company, we supply our meter readers with a card for each individual customer, instead of a book ; that card is arranged to take the readings of one entire year ; it recites the name of the customer, the number of his meter, and so on, and gives each reading so that the meter reader has before him the previous readings for all the time of the year that readings have been taken.

Mr. Dion : That is like our system, except that ours is in book form.

The President : The district is divided by the number of cards given to each meter reader ; the card shows the whole history of each customer's consumption for a year. The card is numbered with the ledger folio and every man's account in the ledger folio must have an invoice rendered for it, and the card is returnable.

A. A. Wright : You have not one of your cards that we can see.

The President : There will be some presented tomorrow.

Mr. Bilger : Is a new card issued every time a meter is changed ?

The President : It is noted on the card.

Mr. Wyse : Do you render your bills quarterly or how ?

Mr. Dion : We have two periods of three months each, and three periods of two months each, five periods for the year.

Mr. Wyse : You don't find that there is more objection to paying them on account of the larger accounts than if they were rendered in closer periods, of say a month.

Mr. Dion : We have not tried them monthly.

Mr. Wyse : I presume the other is satisfactory.

Mr. Dion : The other works well.

A. A. Wright : You never lose anything by customers going away.

Mr. Dion : We occasionally lose a few dollars by people not paying their bills, but we have to take our chances in watching those people.

The President : I may say for your information, that in Montreal we had a large number of quarterly customers, in fact, at one time they were all quarterly customers, and new contracts were taken making them pay monthly, and after that had gone on some time we adopted the policy of rendering bills monthly. Those customers whose contracts provided that they should pay quarterly exercised that right if they wished to, but they got their bills every month just the same, with the result that practically every customer that we have now has got into the habit of paying his bills monthly. It was not forced upon them, but they were given copies of their accounts and they found it convenient to pay. It involves of course some work, extra meter reading and extra making of accounts, but we have found in practice we can get in our returns monthly quite agreeably.

Mr. Wyse : Do you find that you have better results

from that than when you rendered them quarterly?

The President: It has eliminated a great deal of complaint about heavy bills; and it also affords the opportunity of showing a customer's varying use; that is, if he got a bill for two months in the winter time he would think he had a very large amount, whereas one month may have been large and the other one comaratively small.

Mr. Fisk: Do you ever discount a customer's bill if paid on or before a certain date.

The President: We do not; our rate in Montreal was fixed by contract some years ago, but we have lately inaugurated a varying system of rates, very largely on the lines indicated by Mr. Dion in his paper. We impose a penalty of interest after the date in the month provided for in the contract, and also exercise the right of disconnection. We put that in vogue two or three years ago. On and after a given date the customers were notified that their accounts were not paid, and were called upon to pay them within a couple of days after. If they did not, they got another notice that they had not paid, and that at the end of two or three days more if the account were not paid their service would be discontinued. At the beginning we had a great many disconnections to make and reconnections were made upon their paying a dollar. It has gone on; we have lost some customers of course by it, but with no permanent serious loss, until now we have a very small percentage of customers whose bills are collected by the man who goes around to make the disconnection. That is, they wait until he comes around to pay their bill, instead of paying it to the office.

Mr. A. A. Wright: Where you distribute these accounts over three months you say the date is placed on the bill. I suppose you mean you give them the bill for January, February or March, and you merely say "this account is for these three months"?

Mr. Dion: I give the actual date of the reading. There might be only two and one-half months between the two readings, or there may be over three months, as the man who reads the meter may not get around on a certain day.

A. A. Wright: What about these meters, do you charge rent for them?

Mr. Dion: We charge a rent for them.

A. A. Wright: You add three months rent in every time.

Mr. Dion: Three or two as the case may be. We get twelve months in every year.

T. R. Rosebrugh: I would like to suggest, in investigating the question of the behaviour of recording watt meters on inductive loads, it might be well to use a small machine having six collector rings, of which three might be three phase and three six. In this way, with six collector rings, you can get the phases all the way around the circle, 15 degrees apart, and by a suitable combination of a non-inductive load, you can divide the 15 degree phases so that you can have the phase angle almost anything you please.

Mr. Dion: I would like to say a word in reply to what Mr. Gossler stated in connection with meter testing. He objects to testing meters in series because he says an inductive load is introduced which makes the meters go faster. We do not care in that particular test how fast or how slow they go, provided they are all affected alike. The master meter or standard is first carefully tested at all the loads, and it is then used as a standard in series with the meters to be tested, so that so long as the meters are all affected alike, the master meter and the others, we don't care anything about the speed, because we compare the consumption with that of the master meter to determine the accuracy of the meters afterwards.

Mr. Wyse: But then we have to lose so much revenue from having the record incorrect.

Mr. Dion: We first test the master meter for accuracy and then we test the other meters by comparison.

Mr. Wyse: Subject to the inductive load.

Mr. Dion: So long as the master meter is affected in the same manner as the others the particular speed does not matter, because we know that the master meter is correct.

Mr. Gossler: In connection with that matter, I notice that Mr. Dion suggests counting the revolutions of the meter, and if you are going to count the revolutions you have to take the individual meters and test them. If you adjust each meter for an inductive load and place that meter to register on a non-inductive load I don't see how you are going to have it register correctly. There is another thing I would like to bring up in connection with this matter, for discussion, and that is the advisability of adjusting the meter for operating correctly on full load. The time that the meter is in operation or in service on full load is a very small proportion of the total time it is in use, and we have found that adjusting meters for three-quarters load is more equitable both to the consumer and for the company. If you adjust meters to operate correctly at 3/4ths of the load and keep within the government restrictions, I think the results will be certainly more equitable to all concerned.

Mr. Dion: If you refer to my paper you will see we test them at half load.

Mr. Gossler: I beg your pardon.

Mr. Dion: We test the master meter at several different loads but we test the others at half loads.

The President: I suggest that this discussion be not closed to-night, but that we close our business for the afternoon, with the understanding that in the morning the further discussion of this paper be taken up, and that you occupy your time all evening getting up what you wish to say on it. There is a great deal yet to be said on this subject, and it is worth a great deal to the operating companies to have it all exhausted and ventilated. We will now adjourn for this afternoon.

At 5 p.m. the members made an excursion over the Hamilton and Dundas electric railway, and at 7.30 p.m. over the Radial Electric Railway to Burlington Beach, visiting en route the power stations of the radial railway and the Hamilton street railway. Unfavorable weather precluded the enjoyment of an excursion by steamer as per programme.

SECOND DAY.

At 9.30 a.m. the President resumed the chair, and in calling the convention to order said: Before proceeding with the regular business, with reference to the Nominating Committee, it has come to my attention that some dissatisfaction exists with some of the members at the action of the Executive Committee in undertaking to appoint a Nominating Committee. I endeavored to make it clear yesterday that the action of the Nominating Committee is in no sense binding; that everybody here has a perfect right to put in the names of candidates when nominations are called for. The Executive Committee did not intend and do not wish to take out of the hands of the convention that which belongs to it, and I want to say right here and now that if there is anyone who objects to the action of the Executive Committee in appointing that Nominating Committee we should hear from them now. We believed that we were representing the sense of the convention in endeavoring to concentrate our action in nominations, but if there is any objection to it I want everyone to make objection now. If it be the sense of this convention that the Nominating Committee shall not put in nominations, we will ask to have the Nominating Committee discharged; but do not let anyone go outside and say, "Well, I don't think the Executive Committee ought to appoint a Nominating Committee." Say it right here and now. If the Executive Committee have done more than they ought to, sit down on them hard and they will get out.

A. A. Wright: I may say that for one I was very well pleased when the matter came up in the way that it did. I have no idea that this Association should be run by a clique or should be in the hands of a ring, but we must have noticed that when nominations are made miscellaneously one man nominates a friend of his and another nominates a man because he chances to know him, and this thing works wrongly. A nominating committee know all the ins and outs of this thing,

and are supposed to take the matter into deliberate consideration and see that no man is nominated without having his status and the branch of the industry which he represents thoroughly discussed. Although I am a central station man, I don't want this institution to be run by central station men. I wouldn't like to see telegraph men run this institution, neither the telephone men, but I believe we shou'd live harmoniously together. We are all here to help develop this one branch of the industries of Canada. This committee, when they nominate a man, ought to take these matters into consideration, and I believe that they will. And then, as our President has very truly remarked, we have a safeguard ; if there is any man who has been left off, we have a perfect right to nominate that man and give our reasons for nominating him, and if we as a body think he should be elected we have a perfect right to elect him. But I believe this is a good way of doing the work ; it has been found to work well on some other occasions. I would like to see every single branch thoroughly and well represented on the board. I don't want to see any branch enjoy a monopoly of control. (Applause.)

The President : I take it from the applause to Mr. Wright's remarks that there are no objections to the course of the Executive Committee in appointing a nominating committee—therefore I will hope to receive a report from them during the day as to the names of the officers of the Executive Committee, of the President, 1st Vice-President and 2nd Vice-President, but before coming to that point we will proceed with the regular order of business, and that matter will come up under the title of general business. The first order of business is consideration of the reports of committees. We received the reports of the committees yesterday and they were accepted and approved, but the consideration of the recommendations made in those reports would appear to be covered by this item of the "order of business" ; and perhaps the first and most important recommendation is that one of the Committee on Legislation, that the members of this Association formulate some plan covering a period of say five years, whereby each company will contribute yearly a given sum towards the necessary expenses of the Legislation Committee. As Mr. Yule very properly stated yesterday when the time for legislative work begins, a good deal of the energy of the committee is lost in finding funds. They are hindered in the beginning ; they don't know whether they are going to be able to carry out what they wish, because they are not in possession of funds, and funds are undoubtedly necessary to employ representative lawyers and capable people to look after matters, and besides that and beyond that, the idea conveyed by the committee's report was that the Association should be kept informed, kept in touch with all bills presented to the legislature which may affect the general interests of electrical industries. Therefore I think the first question to take up this morning is the formulation of some method whereby that idea can be put into effect, and I shall be pleased to hear from any of you as to what can be done in that direction.

Mr. John Yule : As I understand the report, our recommendation or suggestion is that our successors in office of the new Legislative Committee take that into consideration. At the same time it is brought up for hearing what suggestions may come from members of the Association to give the committee an idea in what lines to work.

The President : As a very active member and an old member of that committee have you any suggestions to offer as to the amount of annual contribution the members might pay? I bring that up merely that it may be considered here, and while perhaps not acted upon, the idea will be growing.

Mr. Yule : That question has passed through my mind several times as to what would be a proper or reasonable amount for the different companies to agree to contribute for five years, and I don't think, even from the large companies, we would want more than $10, and going down as low as one dollar or two dollars per year. It may not be used and it may not be necessary, but during that five years a crisis might arise in which we would want quite a sum of money, and by gathering this fund we would have it in hand. It is thought well we should retain a solicitor in Toronto, examine every bill that is introduced in the legislature of Ontario and in the Dominion house, and see that nothing is lost sight of.

The President : I trust you will not leave out the province of Quebec.

Mr. Yule : We discussed this morning upstairs the question of electing a separate committee for Quebec.

The President : Covering the same idea?

Mr. Yule : Yes. By collecting this fund we would have an amount in hand in case of emergency: We do not want any large amounts ; we rather want a large number of small amounts from a large number of companies. If we got 100 companies to enter into an arrangement such as that, if the sums range from one dollar to ten dollars it would be quite a sum in the aggregate, but it would be a very small amount for those contributing. It is entirely voluntary, and you have to use a good deal of judgment in asking them to contribute. Some companies are better off than others, and some are more willing than others, and it will take a good deal of work to get this scheme organized and get it carried out, but I think it can be done. That is what passed through my mind in making that suggestion. We talked it over at the last meeting of the committee and concluded that something of that kind to successfully attend to this business will be necessary. We have attended two meetings of the legislature ; I have been pretty constantly in attendance at both those meetings, and have noticed the way in which legislation is introduced and carried through. Something may arise in a town or village or city ; the corporation wants something carried through and they find the act interferes with it ; they lay the matter over, and they ask their member to introduce an amendment to that act that will comply with their conditions, with what they want to carry through, and that amendment has to apply either to the whole Dominion, if it is in the Dominion house, or to the whole province. It is often looked upon as not amounting to anything, while very often it is a very serious amendment to an act and it goes through without anybody knowing anything about it, or without anybody being on the ground who is posted on that particular subject to point out where it will operate to the detriment of others, where there are a larger number of people interested, although it may be an advantage to that particular village or town or city. The members do not attend to their duties as they ought to. We all ought to get copies of those acts, and that is part of their duty. I suggest to the gentlemen here now, that they should remind their members in going to either of the Houses that if a bill is introduced that affects in any way a lighting company or any other branch of the industry, that they should send copies of that bill to them. I don't know that I can say anything further to impress upon this convention the importance of this matter being attended to, and of organization for the purpose of attending to it. Mr. Wright has had a good deal of experience, perhaps he can say something. (Applause).

The President: I understand your suggestion to be that this would be a contribution by companies and not by individuals?

Mr. Yule: By companies, not by individuals.

The President: Therefore the maximum of the expense, $10 a year, which you suggest, would seem to be not at all severe upon any operating company?

Mr. Yule: That was the idea.

The President: While a company may have in it a number of members of the Association, as a company the amount of $10 would not be too small an amount to be paid by any of them, and, as you say, if we could get 100 companies organized together to contribute a fund amounting to say a thousand dollars a year, it would put the Legislative Committee of this Association in such a position that the interests of all could be guarded. Being forewarned by knowledge of legislation going on or offered, it could be very easily

overcome; and I think it is proper for us to realize and scatter broadcast among those who are not members of the Association, the idea that this Association desires legislation that only is just and equitable and fair, and that we are organized together for protection against unfair legislation only; therefore our efforts are entirely proper. We have communitive interests usually, and by making our efforts in the direction of proper legislation and guarding against improper legislation, we have a concrete idea to work for which will make our Association powerful and popular and give a reason why companies who are not represented should find representation here. We should grow—and it seems to me that the kernel of that growth is now planted by this legislation obtained last year. I suggest that it be expressed as the sense of this Convention that the next legislative committee be authorized and empowered, and if you please, directed to endeavour to get every operating company in Canada as members of this Association and contributors to the legislative fund.

Mr. Yule: I would not like it to go out that the Association expects $10 per annum from every company. I would mention $10 as the maximum and $1 as the minimum.

The President: It seems to me one dollar is too insignificant a sum for any company. For an individual it is another thing. There is not an operating company in Canada to-day that does not squander $10 for other purposes without hesitation, and it does seem to me that there is not a company in the whole of Canada that would be impoverished or hurt by the contribution of $10. The larger ones can give more if they want to.

Mr. Yule: The method might be adopted this year in sending out agreements to different companies (you know we got an agreement printed for the company to sign, and along with that agreement the amount was suggested to the company; they considered the circumstances of the company and took the liberty of suggesting to them what they thought would be a proper amount for them to contribute, and that worked very well).

The President: That had reference to a special amount which you wanted to raise, not to a continuing yearly amount?

Mr. Yule: Yes. The same principle would apply.

The President: You wanted $100 from some of them and you were content with $5 from others.

Mr. Yule: Yes.

The President: This, I think, is a different line. Those who have contributed $10 yearly may, on occasion, find it necessary to contribute more.

Mr. Yule: The whole of those yearly subscriptions will not be used up each year.

The President: Not each year, no.

Mr. Yule: The committee went over the list of companies and used their judgment in suggesting to those companies the amount they thought they could contribute or agree to contribute, and I do not see why the same method should not be adopted in applying for the yearly subscription.

The President: My suggestion is not that the Legislative Committee receive as the sense of this convention instruction as to the amount that they should seek for, but to have it expressed as the sense of this convention that the most important work that we have in hand now and may have for some time to come is the procurement of proper legislation, and that the Legislation Committee endeavor to get all the companies in the country interested as contributors to a necessary fund.

Mr. Yule: I would like to explain to the Association and have it go out to the companies that the lighting companies in a great measure are handicapped, owing to the division of interests. Other interests are more concentrated; they may be under one board of management, they can bring their influence and do their work in a moment's notice. We are largely handicapped by the amount of work we have to do to get those who should be interested to take action or to support the action of the committee.

A. A. Wright: I would particularly support the position Mr. Yule has taken with reference to the attitude central station men should take with regard to their representatives in the legislature. I think this is a good idea, if we can only get the central station men to follow it up. Take South Renfrew for instance. We have five companies in South Renfrew, and if every one of these companies annually when the local legislature met were to drop a card or letter to our representative, stating to him that they wanted him to be careful and let them know at once if any legislation of any kind whatever were introduced with reference to electric lighting or touching electrical industries if that representative got five letters, one from each of the different companies, he would begin to think there was something in it. He wouldn't want to have the antagonistic element working against him, which these companies could bring to bear, and he would be on the qui vive to keep close watch of what was going on and let these men know. The great difficulty that I see is to get central station men to do their part. It occurs to me to suggest that if this committee should strike off a copy of a letter and every year when the legislature meets should send this letter to the managers of central stations and say, "Would you have any objection to copying out this letter and sending it to your representative in the local legislature?" Certainly that would bring this matter to their attention and I don't think the central station man would object to doing that much in his own interests. My idea is that this committee which is appointed to take this whole matter into consideration I am following up what Mr. Yule suggested in order to bring ideas before this committee —ascertain how much it is going to cost to pay a lawyer to watch this thing in the legislatures, and when we get an idea of how much our expenses are going to be annually, and how much of a sinking fund is required, they would form an estimate of how much of an average would be necessary for central station men, or those engaged in electricity, to give; and that would give us an idea of what we ought to do.

J. J. Wright: I would move that that Committee take these matters up and if the resolution is put in the words that you, Mr. President, gave us a short time ago, I think it would cover the ground.

Mr. Wyse: I second the motion. I was going to say, I don't think the Association wants to give the Committee on Legislation detailed instructions. They are appointed for that business, and they should be capable of discharging it. Whether they adopt a means of looking after the legislation that may come up through central station men, or through lawyers or through both, the manner and details of looking after it should be left to them.

Mr. Yule: The duty of a lawyer would only be to look up the acts that affect us, or amendments rather, and see what the effect of those amendments are.

The President: I understand that the motion does not pretend to enter into details, but to express as the sense of this Convention that the care of looking after proper legislation be the especial duty of the legislative committee, and that they give their best attention to it. No instructions in detail whatever.

A. A. Wright: We were only giving suggestions.

H. R. Leyden: Am I to understand that this committee is look after all electrical legislation? It has been spoken of a number of times as simply taking care of legislation affecting central stations. My idea is that they should include the telephone, the telegraph and other electrical interests as well. Although the Bell Telephone Company have an attorney acting for them, still our attorney would work in conjunction with him. There has been considerable dissatisfaction with the method that has been employed heretofore in looking after this legislation, and there has been friction between telephone, telegraph companies and central station men, and I think the scope of this committee should be broadened sufficiently to allow them to take care of all electrical interests.

Mr. Wyse: I think, in that case, the telephone companies and telegraph companies, as well as central station men, should contribute their quota towards the

expense of looking after this legislation, and not alone central station men.

The President: Both suggestions, I take it, are fundamentally correct.

Mr. J. J. Wright: I think if our Association would co-operate with them, I have not the slightest doubt that they would be willing to meet a subscription covering expenses.

The President: I have no doubt that the Association would be very glad to afford to telephone, telegraph and street railway companies, information which they might obtain in regard to legislation going on, and perhaps in that way make it manifest that our action is beneficial to them as well as to ourselves.

The President put the motion, which, on a vote having been taken, was declared carried.

The President: Is there any other report or recommendation of committees to be considered? (No response.) That appears to be all the consideration you seem to want to give to reports of committees. The next business on the programme is the election of the standing committees, and we will receive the report of the Nominating Committee on that. The Nominating Committee recommend as the Committee on Statistics: Mr. J. A. Kammerer, Toronto; Mr. A. A. Wright, Renfrew and Mr. J. F. H. Wyse, Brantford, Mr. Kammerer to be chairman of the committee. Does this recommendation meet with your approval? (Carried.)

The President: Committee on Meter Inspection—Mr. A. A. Dion, Ottawa; Mr. E. E. Cary, St. Catharines; Mr. J. J. Wright, Toronto; Mr. Dion to be chairman. Does this meet with your approval? (Carried.)

The President: Committee on Legislation—Mr. J. J. Wright, Toronto; Mr. B. F. Reesor, Lindsay; Mr. C. B. Hunt, London; Mr. John Yule, Guelph; Mr. H. R. Leyden, Hamilton; Mr. A. A. Dion, Ottawa; Mr. W. H. Comstock, M.P., Brockville; Mr. A. L. Briethaupt, Berlin; Mr. Wright to be chairman. Does this committee meet with your approval? (Carried.)

The President: In the report of the committee to confer with the Fire Underwriters there was a suggestion, perhaps not definitely expressed, that it might be well to continue that committee, not with the hope of doing very much with the Underwriters, but perhaps in the hope that municipalities might ordain certain ordinances which would bring about the inspection of wiring by the civic authorities instead of by the fire underwriters. Do you wish to have that committee continued with that object in view or let it die?

Mr. J. J. Wright: That refers principally to the province of Quebec, I understand. I don't know that I should be in a position to criticize. If that was referring to Ontario, I should certainly object strenuously to have any power of that kind put into the hands of the municipality, taking into account the manner in which municipalities handle those matters as a general thing.

Mr. Gossler: I might say for Mr. Wright's information that Mr. Hadrill, Secretary of the Board of Fire Underwriters, which I think covers the Dominion, stated that the Fire Underwriters hoped and expected that the municipalities throughout the Dominion would enact by-laws that would make the enforcement of the Fire Underwriters' rules part of the building laws, and he said that was being done in the United States; there were over sixty municipalities there that had included in the by-laws enforcement of the Fire Underwriters' rules, and there had been two towns in the Dominion of Canada, the city of Winnipeg and the municipality of Brandon, so evidently the fire underwriters were starting out with the idea of making inspection part of the municipal by-laws.

Mr. J. J. Wright: My experience of municipal representatives is that they are competent to handle things of that kind.

Mr. Woolsey: In the States in the last few years they have had this matter up before the councils of the various cities there, in relation to the fire underwriters' rules and regulations, and the majority of the cities have taken those rules and placed them among all their other building rules and regulations. Not only have they gone that far, but they have also appointed a man who has to pass a civil examination electrically as an inspector of electrical work and apparatus installed in those cities. Besides that, the underwriters themselves have an inspector or inspectors, who cover a certain territory, and before any work is done electrically in any way, they have to apply to the various electrical inspectors of the various cities in which the work is done before they go ahead. They must get a permit from him before they do any work. After the permit is given they have to apply to some of the managers of the board of fire underwriters in the various localities and secure a permit from them before they can go any further. After that permit is granted they go ahead and do their work, and then the inspector must inspect it before any current is turned on. They have made it a very rigid rule, and in consequence the work is being done far better than it has ever been done before. There has been less trouble in the last five years in electrical wiring than in all the years before, and it is all through the municipalities adopting rules and regulations laid down by the board of fire underwriters.

Mr. Wyse: I think the municipalities adopting those rules and trying to enforce them would only be an assistance to what we want at the present time, perfect wiring.

The President: In the Province of Ontario it happens that one of our very oldest members has the matter of inspection in charge, and it is undoubtedly through his personality that common sense application of these rules is given, but elsewhere the whole difficulty with the situation is that there is no centralized authority anywhere which can call upon and be called upon to see that any given set of rules is carried out, and the sense of the convention last year was that the advantage of the operating companies was to have some authorized authority who would look after this matter and see that any rules, be they whatever they may, be carried out. Now, whether it be by the municipalities or board of fire underwriters, is immaterial. If the municipalities take the rules of the board of fire underwriters, and make them the law of their municipality, then it becomes incumbent upon everyone having to do with them to execute the law. Thereby we get a responsible centrallized authority, and, as Mr. Woolsey said, any corruption or mismanagement is guarded against in the States by the board of fire underwriters in addition giving a certificate. Therefore, if there be any contradiction between the action of a municipal inspector and the underwriters' inspector, it is discoverable at once. If the corruption extends to the inspector of the board of fire underwriters as well as to the inspector of the municipality, then of course the company or customer suffers. But when you establish a certain principle by law, then you have a lot of inspectors, that is, you have the general public and the law itself. Last year it seemed to be our view that we wanted somewhere in some place somebody authorized to supervise this thing intelligently.

J. J. Wright: I think the whole loss falls on the fire underwriters; they are the proper parties to see that the work is done according to their ideas.

Mr. Gossler: In regard to that, the committee tried to explain to the sub-committee of the fire underwriters that the fire insurance companies were really the losers in the matter, but they did not seem to see it in that light. It seems to me they are perfectly willing to accept the certificates of the electric lighting companies if they will certify to the fact that the wiring has been done in accordance with the board of fire underwriters' rules; but for the lighting companies' and power companies' own protection I think there should be an independent inspection from an outside source. I speak of that for this reason when it is left to the electric lighting companies or electric power companies they are liable to draw on their imagination as to what constitutes compliance with the board of fire underwriters' rules. I know of several cases where very objectionable installations have been put in and objected to by

one company, and another company has come along and taken them right on those lines.

The President: Is it your wish, gentlemen, that this committee should be continued, to report at the next convention what they find can be accomplished? (Motion carried to continue committee.)

A. B. Smith: Who are the committee?

The President: Mr. Dion, Mr. Gossler and Alderman Sadler. There was another member, Mr. Badger, and it would be proper to appoint someone in his stead, and I will be glad to receive suggestions. Mr. Badger was appointed because he was in Quebec. Mr. Sangster, would you be kind enough to act as the other member of the committee? Mr. Andrew Sangster will be the remaining member of that committee. Now, the next business before us is the selection of the place and time for the next meeting of the convention.

Mr. Dion: I desire on behalf of Ottawa city to extend a cordial invitation to this Association to hold its next convention there. I can assure you of a very hearty reception, and I do not think it is necessary for me to say very much in support of this invitation, because it would seem as if it were Ottawa's turn to get it. We have not had a convention of this Association for five years; since that time it has been in Toronto and been further west and also further east. Ottawa is a central place, and I have spoken to a number of members about it and they seem to be quite agreeable to the idea. At any rate, I propose Ottawa, and I hope the convention will decide to come there. (Applasue.)

The President: It does not seem to be any use to ask for any who are contrary minded to speak—therefore it will be Ottawa next. (Prolonged applause.) The next item on the programme is General Business.

Moved and seconded, that this Association express to Mr. James Conmee its appreciation of his earnest efforts in securing equitable legislation concerning the electrical industries of the province of Ontario, and that the combined Executive and Legislative Committees be instructed to convey this expression to Mr. Conmee in a proper and fitting manner.

A. B. Smith: I would move, seconded by Mr. Yule, that our Secretary be allowed the usual grant for the year. Carried.

The President: Now, gentlemen, we arrive at the question of papers, and we adjourned yesterday with the discussion upon Mr. Dion's paper unfinished. We had, perhaps, fully exhausted that element of the subject having reference to testing and methods of reading and so forth, but have not taken up the question of rates. If there be anything more to be said on the matter of meters, meter placing, meter testing and meter reading, we should be pleased to hear from you now, and I want to repeat what I said yesterday, that I hope that everyone here will take an active part; if necessary, rap another fellow over the knuckles in order to get some fire into our discussion.

Mr. C. H. Wright: Mr. Dion in his paper at page 2, section 4, says, "The current should be calculated from the indications of a Siemens dynamometer. If none is available, the wall ampere meter, which should be frequently calibrated, may be used instead." I think a Weston ammeter will be found more convenient and reliable. Last year Mr. C. E. Haskins, the meter expert, provided a plan of testing meters in houses. He takes a bank of lamps of a lower voltage than those in use on the company's wire and calibrates them at different voltages, and he can test the meter without any disturbance whatever, and this removes any doubt that may be in the consumer's mind as to the accuracy of the meter. On page 3, under the heading "Station Meters," Mr. Dion says, "The practice of metering the output of the central station, which is becoming quite popular, is a move in the right direction. The data obtained through the use of station meters is not otherwise available. It is sure to lead to economies in the station, and will be of material assistance in making and re-adjusting rates." I doubt the reliability of this data. Furthur back Mr. Dion refers to the size of meters in relation to the load. When we install a large meter for measuring the total output, this meter at certain hours of the day will work on a very light load. Take the case of hotels, where the lights are burning late, you will have lots of meters working on practically full load, whereas your large meter in the station is working on low load; in fact, after twelve o'clock it is no uncommon thing to see this large meter stop altogether. You take and add up your house meter readings and check them against the main meter in the station, and the difference is altogether too great. Large differences in stations, perhaps, are to be looked for where we have transformers. In one station where I was employed, we thought there was something the matter with the meter, and had it recalibrated; in all cases we got difference of from 20 to 30 per cent. between the total readings of the house meters and the main meter in the station. I know we calculated our other losses to be about 5%, and the transformer loss could not have made up the 25 per cent. difference present. So that the fact of these large meters working on small load, looks to me as though the data thus obtained is not perfectly reliable.

A. A. Wright: We had as high as 36 per cent. loss once in a large bank of transformers. You promised to show us that card.

The President: That will come up in the reading of the next paper. Is there anything further desired to be said on this question?

Mr. Leyden: I want to say a word as to what Mr. Dion said as to when a customer objected to the reading of the meter, immediately removing it and replacing it by another meter. To my mind this is not the best way out of the difficulty. Mr. Dion states that it is not the proper method to test a meter on the premises. While you might not be able to get as accurate results on the premises as you would in your own testing room, still, if you do get any results at all, and they are anywhere nearly correct, the customer is a great deal better satisfied, and is very much less liable to complain the second time than if you take the meter out and put in a correct one. If you can show to him right on the premises that the first meter is correct, you are not liable to have much further trouble.

Mr. Fisk: I do not think it is hardly the right thing to do to have to humor every customer into believing his meter is right. We pay the Government for informing the public as well as ourselves that these meters are correct, and if a record is kept of the original test of these meters, and that is shown to the customer, I think that is far enough. If he is dissatisfied, then the law provides that by him depositing the proper amount the meter can be verified, and then there is no doubt about it at all. If you try and humor every customer that is dissatisfied, you have abig job on hand. If you take one man's meter out and put another one in exactly the same, perhaps his conditions will change a little; he gets better results and he at once says, 'I know what is the matter, that other meter is wrong'. He tells all his friends, and you have got to change everybody's meter; whereas probably the meter is all right. We pay the Government for testing these meters, and they have the option of depositing their fee and getting the certificate themselves, and if they do that, this certificate not only answers their purpose, but it also gives the lighting company another lease of life for five years on that particular meter, which I think is the proper way.

Mr. Dion: Have you any competition in your town, Mr. Fisk?

Mr. Woolsey: This meter question I think would apply to the province of the legislative committee. In several cities in the States that same question of doubt has arisen with the subscriber or with the consumer as to the meter being correct or not. It has gone into the board of electrical control of the various cities. When the consumer makes complaint or has an idea that his meter is not reading right, he applies to the board of electrical control, the inspector of it is the inspector of all electrical work, and the customer has to take his meter out and take it to the inspector's office, or else the inspector comes to the house and inspects the meter, and then if the meter is found to be out, or is found not to be correct, the company has to pay one dollar to the inspector and put in a meter that is right, but if it is found to be correct then the customer has to pay the dollar to the inspector.

Mr. Yule: Our practice has been to explain to the custom-

ers complaining of the meters that our measures are certified to by the government as being correct; that we have practically no control over the meter; that it is tested and sealed up and put on the premises; and we refer them to the inspector without giving them any information as to making a deposit or anything at all. In nine cases out of ten we do not hear anything more from them. The inspector explains to them what the operation of the law is and what is necessary.

Mr. Henderson: In reference to testing meters in houses, you take a meter that has been changed from store to store and the meter has been running slow; it is moved to this new place and through transit it has jarred the jewel and it is running slow, whereas in the last installation the meter was probably running fast. Another point in changing meters: A man complains of his bill; it is true that the meter, from his previous readings or accounts, is running fast; at the same time, if that meter were tested in that house without removal, it would obviate the danger of jarring the jewel and it would be a great advantage.

A. A. Wright: It is very fortunate that Mr. Dion introduced that clause into his paper. You can not give any hard and fast way in which these things can be adjusted. A great deal depends on the man that has to deal with the woman. (Applause). You have to be guided by circumstances. I am not particularly touched with the blarney stone of the Irishman, but still I find it necessary to use the persuasive element with a great deal of dexterity and a great deal of suavity of manner to get over these difficulties; you can't handle any two alike. When all fails I tell them that of course it is possible this meter may be running wrong, but we believe it is right, and if they are prepared to put up sufficient money to pay the expense, we will bring the government inspector and have it examined, and if it is wrong we will pay all expenses, but if the meter is correct and found to be going right they have to pay the expense. I never found that to fail in satisfying the woman.

Mr. Yule: The only way is, if they think it is desirable to have an inspection made of the meters on the premises, let the Government inspector do it; he is the most neutral. If officials of the company go there for the puspose of persuading the people that the meters are all right, it will have little effect.

Mr. Dion: I find in Ottawa that the Government inspector refuses to test meters on the premises; you have to take the meter down and take it up to his office, so that unless the owner of the meter comes along with his meter, there is no certainty to him that the meter has not been tampered with before it reaches the inspector. I would like to know what the practice is in other places?

A. A. Wright: One other scheme I have adopted with reference to this—when the first complaint is made I say, "really, I don't think there is anything wrong with this meter, for this reason, that the meter we have put into your place is a test meter that we got from the factory expressly to test our meters by. (Laughter.) It is not any ordinary meter that you have in your place, but it is a test meter."

J. J. Wright: May I ask Mr. Wright what particular church he stays away from when he does not go?

A. A. Wright: Mr. President, I am a leading member of all the churches. (Applause.)

Mr. Gossler: Three or four years ago the Royal Electric Co. had numerous complaints from customers of their meters either humming or running too fast, or not in accordance with the light consumption, and we undertook to maintain that our meters were right, although we didn't know quite ourselves whether they were or not. But we undertook to say they were right. We started an investigation, with the idea of being able to maintain that those meters were right or else finding out for ourselves whether they were right or wrong; we started out with a very thorough investigation and made tests. I may say safely that we had hundreds of complaints of meters running fast. Since that time we have gone into it not with the idea of humoring the customer, or using blarney, but maintaining that what we said was correct. We reduced our complaints down. We have some 3000 meters in use, about 3000 customers, and I am safe in saying we have not within the last year had 25 complaints; we have, in every case, undertaken to show the customer that the meter was correct; we then tell them that the meter has been subjected to our own test, and has been passed by the Government inspector, and if they so desire they can call in the Government inspector to verify our statement; and we have practically eliminated complaints from customers. We use several meters—the Schallenberger meter principally, the Siemens meter, and some Duncan meters. I don't think it is a question of humoring the customer at all, it is maintaining the fact that you are right.

J. J. Wright: The unfortunate part of this business is that meters very often do go wrong.

Mr. Gossler: I may say in connection with that question that we have taken up the matter so thoroughly that we do not find that many of our meters go wrong.

J. J. Wright: That would refer more particularly to alternating current meters, which you know are very much more reliable than the meter used on direct current.

Mr. Street: I find about the easiest way to satisfy a customer making any complaint is to maintain that the meter is correct, and to at once refer to the account and say, have you compared your account for a period this year with the corresponding period last year; and on doing that (it can be done in a very few minutes in the office), I find the customers are very easily satisfied; that in many cases it can be shown that the accounts are not any higher, very often less, and they go away quite satisfied. I find that a very satisfactory way.

A. A. Wright: That is a good way: that is one of the ways I have adopted too, when everything fails.

The President: Apparently you all realize the same thing. After all, the most effective way of dealing with your customer is to take him entirely into your confidence: explain to him fully all the workings of the meter, explain to him why his meter operates, why it registers, and why it registers a certain quantity; inform him as much as you can, give him all the information you have on the subject yourself, and he then realizes that you are intending to give him what he pays for, and that you desire him to know how he can determine it for himself; and I may say that I have found that method effective rather than when any referment to the government inspection or any test or examination was offered. The very fact that you tell him all that you know about it, so that he will understand that you take him into your confidence, satisfies him. If there be no other remarks on that branch of the subject we will take up the question of meter rates. For the purpose of starting the discussion, I may say that in Montreal we have practically three systems, one of them is the single rate, another is payment of a given amount for the first hour per lamp per day, and a very small amount for anything in excess of the first hour per lamp per day: the third method is to charge a fixed monthly sum, that being ascertained and determined by the leakage current of the transformer having been ascertained and a value put upon that; then the value of the transformer ascertained and a percentage of that amount added to the leakage current value, and in addition to that a sum representing the interest or return that you want upon the capital invested in your entire plant for that amount of current that that man wants as represented by his transformer capacity. We have figured those out for all the various sizes of transformers so that our canvasser is able to say to a man, if you want a 50 light capacity transformer you will pay us so much per month and without any reference to your burning, and in addition to that pay us a sum for the current register. That plan is perhaps the most fair to all parties, but it is not accepted by some of the customers because it calls upon them to pay more than they would pay upon the single rate plan, thereby determining that they as customers upon the single rate plan are a loss to us, because the fixed sum that we determine in that way covers the cost of current that we give him in leakage, covers the cost of the investment we have made to be able to give him the service up to that capacity, then the amount that he pays for the current that he uses represents the costs of making and delivering that current to him, plus whatever profit we want on the transaction. Thereby every customer is placed upon an even footing, each man pays his proportion of the investment that is made for him, and he actually pays the cost of manufacturing the current which he actually uses. I may say that we have on the first hour per lamp per day plan, and upon the transformer leakage or energizing plan, customers to the extent of nearly 2000, our single rate customers being principally residences and some small stores. Either of those plans cultivates the long hour user,

or the use of the current for a longer period. When you make the price for the excess over the first hour per lamp per day small, the user does not feel the necessity of econimizing and cutting off the light; that is, he feels he can burn another hour with very small cost, and that encourages, therefore, long burning. On the other plan the man realizes he is paying for the current he actually consumes and a small amount to excess to make the total price less per hour when he uses more current.

Mr. Fisk: When you have a number of customers and varying loads on one transformer, how do you arrive at it then?

The President: We undertake to determine the maximum transformer capacity of each customer and rate him accordingly for the transformer energizing term.

Mr. Bilger: Do you give the customers a chance of changing to either one or the other of these methods?

The President: Not after he has made his contract; we have that determined at the beginning; and I may say we try to point out to the customer what the effect of the different plans would be.

Mr. Wyse: Do you endeavor to put all your customers on contract?

The President: We have none that are not; we won't take a man that is not.

A. A. Wright: How long is your contract made for?

The President: We have nearly 2000 for five years and none less than one year. We will not take a contract for less than one year, except that which is known as temporary service, and for temporary service the customer pays the cost of installing and the cost of removal, and then ordinary current rates if the service is in the summer; if it be at the time of our heavy load in the winter, we make him a special price. We take no one without a signed contract.

A. A. Wright: What do you mean by removal?

The President: The cost of removal of the installation. Suppose a man wants to put up 100 or 200 lights for illuminating, he has to pay the cost of putting up and taking down

A. A. Wright: That is when it belongs to you.

The President: Yes. We don't wish to give a customer the right to withdraw at any time he pleases; we must formulate and arrange our business so that we know what we have in sight, what we can prepare for; the question of competition does not enter into it at all; when we make arrangements to supply a man we want to make arrangements to supply him for a given period of time, and that period of time we know, and it is fixed by contract.

Mr. Wyse: Doesn't competition enter into it very materially then, though indirectly, because if you didn't have any contract he would have the right to go to a competing company at any time.

The President: A more important feature would be that he would have the right to give up using the service and go to candles if he wanted to.

Mr. Wyse: If there wasn't some competing company that could give an equally good service, say for instance in electric light, there woudn't be any inducement for him to change.

The President: Perhaps I might better say that it is competition, because it is competition from candles. A man who is not under contract with you and is dissatisfied either with fancied error in his bills or the personality of the manager, may in revenge give up the use of the light, and if he cannot get gas, burn kerosene oil and candles; in fact, we had one case in Montreal where a man wouldn't pay the price we asked him for some temporary purpose who said he would go back to candles rather than burn electric light; and he did, as a matter of fact. The purpose is to hold your business in hand for a certain specified time.

Mr. Wyse: And against any or all competition.

The President: It has that effect.

Mr. Bilger: How would that act with a customer who was put out of his premises.

The President: We endeavor in taking a customer to ascertain his financial status, and if he would be such a one as would be likely to be put out for non-payment of rent, we request him to provide a deposit sufficient to cover about two months' use of his service.

Mr. Dion: In the case of a man discontinuing the light through no fault of his own, having to leave town or something of that sort, do you enforce the contract strictly.

The President: No, we do not. Where a man honestly is unable to carry out the contract, we exercise the discretion of waiving our rights, but the object of the contract and the contract throughout all its phraseology is intended to protect the company against wrongdoers, and not against the man who wants to act honestly. I may say that we have customers who oject to signing our formal contract on the ground that it is too restrictive in favor of the company, but by calling their attention to the fact that it is only restrictive as against those who want to be dishonest, every reasonable man accepts it.

Mr. Noxon: Is your five year basis upon the same basis as the one year, or does it anticipate the probability of reduction in rates before the end of that period? Is there any anticipation or provision for that?

The President: The five year contracts are fixed for five years at that rate; the five year contracts are, as I say, on either of th se two basis that I spoke of, so much for the first hour per lamp per day and a very small amount in excess of that, or transformer energizing current and a small revenue. The single rate contracts are all subject to change in price.

Mr. Noxon: In consideration of a man giving a fixed contract for five years, would you make any reduction in the price for the five year term over and above the price for the one year term?

The President: Yes, these rates I speak of are a reduction.

A. A. Wright: What do you mean by the first hour?

The President: The first hour per lamp per day means the first ampere hour of use, or the first 50 watts hour of use, and it is arrived at in this way: An installation of say 25 lamps should register the equivalent of 25 ampere hours per day. At the reading at the end of the month we will say that the reading of the meter shows that the number of hours is 1200; one hour per lamp per day times 25, or 30 times 25 would be 750 ampere hours to be charged for at the rate of the first hour, and the difference between 750 and 1200 at the lower rate.

A. A. Wright: That causes some labor.

The President: Not very much labor. It is one calculation for the year or one calculation for five years. You have 25 lamps and 750 hours, and that is simply noted on a man's account, or rather 750 hours is charged for at the first price and anything in excess of that is charged at the other rate.

Mr. Fisk: How do you keep informed as to the actual number of lamps a man has?

The President: We endeavor to do that in several ways. Where customers have lamps added, as they frequently do, we endeavor to establish the rule, and for their own protection to guard them against being out of a service, to notify us of that addition, and we have made a great many of our customers think that it is to their advantage as well as to ours that they should give us that information; but it frequently happens that they forget it or they do not do it, therefore we periodically make a recount of the lamps in the customers' premises, and our lamp renewing man and our meter readers are cautioned to look out for anything in the way of new work since their last visit.

Mr. Wyse: May I ask how often your meters are read and the bills rendered?

The President: Every month.

Mr. Dion: Mr. President, we have had a good deal of information about your company which is very useful; I would like very much to hear from Mr. Wright, of Toronto, representing a large city, as to meter rates there.

J. J. Wright: If you have any questions to ask I shall be glad to answer them. We have simplified the matter in Toronto very greatly, and at the same time we have the advantage in that way of the demand system, by separating the commercial lighting from the residential lighting, and making two discounts, very largely in favor of the residences. We allow 40 per cent. for commercial premises and 60 per cent. for residential premises, for this reason, that the man at the residence is the long hour burner; he burns his lights every night in the year and for three or four hours per night, probably, whereas the man in the store closes at five or six o'clock and burns his lights only for about a month or two in the winter time, and that only for an hour probably, therefore we make the discount so much greater for residences.

The President: Except when he is off on his vacation.

J. J. Wright: The meter goes just the same. (Laughter.)

A. A. Wright: That would not apply to a barber or men of that kind that burn their lights till 12 o'clock at night.

J. J. Wright: We have to make exceptions; we sell our light in Toronto very much in the same way that the huckster sells his fish or the farmer his potatoes, we get all we can for it; and we regulate our rates by the amount consumed, by the number of hours that the consumer burns his light, and we make an estimate very often in each case as to what the rate shall be. This applies more particularly to flat rate customers, of which we have a large number. It is quite as much in order for us to go to a man's premises to make an estimate from the information he gives us and from the knowledge we have of his business and his probable requirements, of the amount of light he is going to use, as it is for a carpenter when he gets a specification for a building; he comes and reads over that specification and looks at the general plan of the building, and what extras there may be, and he estimates what that is going to cost him, and what profit he is likely to get out of it. We go and make a general estimate from our knowledge of the business and from the knowledge of their requirements as to what we can afford to do. I find the plan to work very well. We have very severe competition from the gas people; gas in Toronto is 90 cents per thousand, and that makes it interesting for the electric light people. But I started out with the assumption that we have got to have this business, and if we can't get it at one price we have got to have it at another. I find that works pretty well. As customers become undesirable we drop them off. We have a check meter on all the flat rate customers, and if we find they are abusing our generous confidence we tell them so, and give them a hint that if they want to get a renewal of the contract they will have to moderate their transports or they will not get it again, and that generally brings them to time. So in that way I don't think we lose as much by the flat rate as is commonly supposed.

Mr. Henderson: The two rate system in Hamilton has met with great success. Where we have lost a customer through the gas company, and have had his records of a year's consumption, we have approached the man and made a flat rate with him in this way, by taking the readings for the previous year, and where he was only getting a discount of 25 per cent. we would make it 33⅓, and at the same time making it an inducement to him to reduce and keep his lightingrate down, whereas before with the flat rate he used it extravagantly. We have got quite a number of our customers back in that way. This summer we purpose going in for window lighting, placing them at a fixed rate; and the contract will be that he is to burn the lights until half-past ten or eleven, as the case may be, and then we will have to switch the whole system off. In that way it will illuminate the town and make our light more popular, and be a splendid advertisement for the business men. On the first of May this year we increased our discount on residential lighting, and so far we have received quite a number of customers through it, and in that way, in the course of a few months our residential lighting will increase very largely through the additional discount. We make our residential discount 40 per cent.; it has been 25 per cent. heretofore.

The President: It is now a quarter to twelve and we have several more papers tobe read, and and we are to be back here at half past two; I thought, however, it might be proper to take the necessary time to read another paper, and as the one I have in mind is almost in the same line as the matter we have been discussing, that is, having reference to rates and so forth, and is non-technical, whereas the others are somewhat technical, we might have this paper read just before we close this session now, and after dinner we will be able to discuss it. Before Mr. Hart reads his paper I would call upon some of the members of the Association to express the very earnest thanks of this Convention to Mr. Dion for his paper.

Mr. J. J. Wright: I have great pleasure in moving that the thanks of the Association be tendered to Mr. Dion for the very able and interesting paper he has read on this question.

Mr. Gossler: I, in seconding that motion, would like to call the attention of the Association to the great detail that Mr. Dion has brought out in his paper, and the great value that it certainly must be to anyone who looks over it carefully, I take great pleasure in seconding the motion.

The President put the motion, which, on a vote being taken, was carried amid applause.

Mr. P. H. Hart at this point read his paper entitled "Central Station Accounting from a Business Standpoint." (See page 163.)

The reading of this paper was greeted with applause.

Mr. Hart: The various forms that I refer to in my paper are here for your inspection, and by an examination and inspection of them I think you will grasp the meaning of the paper much more readily.

The President: It is now nearly ten minutes after twelve, and the next session will begin promptly at half past two Are you desirous of spending a little more time before we close this session?

Mr. A. A. Wright: Will these forms be published?

The President: They will be published.

Mr. Leyden: I don't see that we can discuss this paper very much without havingthe forms before us, because the forms are the substance of the paper; Mr. Hart has outlined his general ideas, but the details are not given in his paper and we can't discuss it until we see these forms.

The President: Suppose we spend a few moments in circulating them around.

On the suggestion of the President the forms were inspected by the members present, after which the President declared the Convention adjourned until 2:30 p.m.

AFTERNOON SESSION.

The President in the chair called the Convention to order and said: Gentlemen, before we take up the discussion on Mr. Hart's paper, I think it is desirable to announce now the names of the officers proposed by the nominating committee. The election of officers will take place to-morrow morning, it will be the first order of business so that you will have before you between now and then, the names of the officers the nominating committee have thought advisable to present for your votes:

"For President, Mr. A. A. Dion, Ottawa; for 1st Vice President, Mr. Geo. Black, Hamilton; for second Vice President, Mr. P. G. Gossler, Montreal. Of the old board of the Executive Committee the five to be re-elected are Mr. J. J. Wright, Toronto; Mr. A. B. Smith, Toronto; Mr. O. Higman, Ottawa; Mr. E. E. Cary, St. Catharines and Mr. John Carroll, Montreal; the new members of the Executive Committee to be, Mr. D. R. Street, Ottawa, Mr. W. H. Browne, Montreal, Mr. A. Sangster, Sherbrooke, Mr. J. F. H. Wyse, Brantford, and Mr. B. F. Reesor, Lindsay."

The President: This is purely and simply in the way of an announcement. Now for the question of Mr. Hart's paper.

Mr. Dion: Mr. President, Mr. Hart gives an account in his paper of how orders for work of various kinds are issued and I would like to ask him if he experiences any difficulty on account of these orders being mislaid by the men who handle them, or whether he has any system of keeping duplicates of orders.

Mr. Hart: I might say for Mr. Dion's information, that when an order is issued a duplicate of it is filed away. The orders are all in book form; the original is taken out, a perforated form is taken out and handed to the man, and the book is filed away serially; a record of unfinished orders is also kept and checked up so that any unfinished order can be checked and called in, and the reason why it is not completed seen.

Mr. Street: The statements in Mr. Hart's paper might almost be taken as a suggestion from him that there should be a committee appointed to standardize the system of accounting throughout Canada; I think this certainly would be excellent, although it might take three years to do it. There is one committee now, it might come under the head of one of the present committees, the committee on statistics; possibly they might consider this. It seems to me this is something that is wanted very much. It would give the smaller companies, in fact, every company, a chance of comparing the particular branches of expense and the particular branches of revenue. At present now, for instance, one company cannot tell very well, supposing he has several hundred lights installed, whether he is getting sufficient revenue from those lights as compared with some other company, and there must be a reason for the difference; the expenditure may be two or three times as great in one company sa in another. If there was some systematic way of distributing the revenue expenditure among all the companies this comparison could be arrived at. I don't know whether a motion to that effect is in order?

The President: A motion to appoint a committee for

the establishing of a standard system is certainly in order.

Mr. Street: I would have great pleasure in moving that a committee be appointed to standardize the system of accounts.

Mr. Bilger: I second that.

The President: The motion is that a committee be appointed to arrange if possible a standard system of accounting for central electric lighting stations belonging to this Association. The question is open now for discussion, and in process of the discussion of that motion you can probably further take up the points of Mr. Hart's paper. Does anyone wish to raise any objection to the appointment of such a committee?

Mr. Hart: Speaking to that motion of Mr. Street's, the wording of the motion hardly, I think, covers the idea I wish to convey in the paper, which is, to appoint a committee to standardize the system of accounting for central stations operating in Canada. That is the idea of the paper. Mr. Street's motion is as to the stations the managers of which are members of this Association. I think if the motion were put to read, "the accounting is to apply to central stations operating in Canada," it would more properly cover the point, than simply putting his motion in that form, that the standard system be applicable only to members of this Association.

Mr. Street: I am quite willing to change the motion, in fact the motion may be worded in any way that is suitable. I am quite agreeable to change it as Mr. Hart suggests.

A. A. Wright: If I remember, about four years ago the National Electric Light Association arranged for a thing of this very kind; blanks were furnished and every member of the National Association received a copy of these blanks, but nobody else. Of course, it is not necessary we should follow their rules, but they considered that subscribers or those who assisted in this way should get the full benefit, and those who remained at home in the manger should stay there.

Mr. Gossler: If I understand the paper rightly, the main object of it was to impress upon all the necessity of keeping a system of accounts whereby the cost of production would be obtained, and I really believe there are very few of us who can tell exactly what the cost of production per arc lamp hour is. While I would not for a moment discourage any movement to establish a systematic or standard method of accounting, it seems to me that the first thing to be impressed upon us is to be able to tell exactly how much it costs us. I think the object of the paper is to establish the fact that a system of accounting to obtain those ends is the first thing to be gained.

The President: As I understand the paper, it is a recommendation that some general system that can be used by stations of all sizes, and be of a uniform plan, should be recommended for adoption by the members of the Association, and that the author of the paper has undertaken to show by a system already in vogue, how the costs can be ascertained, and how they can be ascertained in the various forms—the various details of those costs. And the purpose of the motion now offered by Mr. Street, I understand, is to carry out the suggestion of the author of the paper, that a uniform plan be adopted by this committee, and report to the Association as being one that is feasible for all companies to use, and recommend that all companies do use it, so that they will have some basis upon which to compare their various costs of operation, and the various sorts of revenue. Having different methods of accounting, one man is able to say, well, the inspection of my lamps costs me so much; another man is not able to say whether it does or not, because he has it involved with something else. One man is able to say how much it costs him per hour of output for fuel; another man is not able to say that because he has incorporated with the cost of fuel wages of the men, handling, and so on, and I take it that the purpose of the author of the paper and the mover of the motion is, that this committee will take this matter in hand, and endeavor to recommend some uniform plan which will achieve the result. Am I correct?

Mr. Hart: Quite correct, as far as my paper is concerned.

Mr. Street: Yes.

The President: I would like to hear any objection that there may be to this, if any.

Mr. Noxon: I can not see how there can be any objection to it on the part of any person, excepting the committee. This is a thing that is offered to the Association, as I understand, without money and without price. They can use it as they see fit; we don't have to do any work in connection with it outside of the committee. I don't see why we should kick if the committee will do this work; I don't see that we can raise the least objection; I think, on the other hand, that it is a thing that would be of very great benefit. There is no doubt, whatever, that every person connected with electric lighting interests knows that the matter of keeping accounts, and to tell what your light is costing, and what you are producing it at, and what you are getting for it, is one of the most important things in connection with the business, especially in this business where the margins are fine. If this committee will take upon themselves to do this work I certainly think this Association, instead of taking up the matter and debating every question, should be very glad to accept of their kind offer to do so.

The President: I take it, however, gentlemen, that the assentive action of this Association to the formation of such a committee carries with it some application by making use of the results of that committee's work.

The President put the motion, which, on a vote being taken, was declared carried.

The President: I will now appoint as that committee, the mover of the motion, Mr. Street, the author of the paper, Mr. Hart, and I think our friend Mr. A. A. Wright, of Renfrew. (Applause.) Is it desired to have any more talk on this paper? If not we will proceed with the other one. Before proceeding to the reading of the next paper, as the result of our question box up to date, we have one question, and I will call upon Mr. Leyden in the hope that he may be able to answer it. "What is the watt gain in transmission on the line of the Cataract Power Co.? How do you explain it? Could it be possible that the line is crossed with the Radial Railway?" (Laughter.)

Mr. Leyden: Of course, most of you understand that there is no watt gain at all; there is a gain in the rise of electrical potential; we have a higher potential at this end than we do at the starting end; at no load it is ten per cent. and then it varies as the load comes on; the moment you equalize that by self induction due to transformers or motor load of any kind it disappears. There is no gain in watts at all, and the weight of evidence is that while you have 10 per cent. higher voltage on this end of the line, you have a current flowing into the line from the other end that may have 20,000 volts; we have about 18 amperes per phase on 2,000 volts, and it is shown that there is no load on this end at all, that the current coming in here just counterbalances the rise of potential at this end, and when we put a small load on this end the current at the other end still shows up about the same rate; that is, we can put say five amperes of current on this end and it won't increase the current at the other end at all, because there is the 18 amperes originally going in there, and that decreases as the load increases. There is still, however, with a very considerable load on, a matter of a thousand h.p., a slight rise in potential at this end over what it should be, but there is no gain in watts. There couldn't be. But it is a phenomena that is well understood and known as the Ferranti law, and it is figured out beforehand to determine the capacity of the line, and you know exactly what the effect will be. But there is no gain in watts at all, just an apparent gain in potential.

The President: We have a few other questions which have arrived, one is "Where is the proper place to begin charging customers for wiring—at the property line or inside of the building, or any other place?"

J. J. Wright: I should charge right from where it touches the building, then if it burns the fellow down he can't saddle you with the cost of it. Charge for the wiring the moment it touches the property line, that is, the building itself, or gets on the property of the consumer; it is his wire, and he is responsible for the safe keeping in every respect.

The President: What about the meter?

J. J. Wright: The meter, of course, would be excepted, but the wiring would be the property of the consumer.

A. A. Wright: The cut-out and the switch?

J. J. Wright: Yes.

Mr. Leyden: I should say that all property on the premises, beginning at the property line, should belong to the customer, with the possible exception of the meter, for this reason, that all fixtures on a property are subject to seizure for debts; anything that is attached to the property is subject to seizure. Of course, as to the meter, you put it on the property and you put it on at your own risk, but even that meter is subject to seizure for debts, as I understand it.

The President: In that connection I should do as was mentioned in an argument I had with a certain gentleman some years ago, have the charter changed, or perhaps better, have the law changed whereby the landlord would not have the right of seizure of the property of the company after they had been notified that the company had property on that building. I may say the charter of the Royal Electric Company was amended in that respect, and all we have to do now is to notify the owner that we have that property there subject to that law.

Mr. Leyden: What do you do in the case of a mortgage on the property?

The President: Send a notice to the mortgagor.

Mr. Gossler: I don't agree with the suggestion of Mr. Wright or Mr. Leyden, because in many cases you install primary installation, and you would hardly charge for primary wiring and transformer; I should suggest all secondary wiring attached to or on the premises.

Mr. Leyden: If you put it on there, you put it on at your own risk.

The President: The suggestion made by Mr. Gossler is one worth thinking about. As our business grows older and more extensive, undoubtedly it will happen that very frequently transformers will be placed in the buildings, and it would be a doubtful question as to whether you would want to sell your customer the transformer, whether you might not wish to retain the transformer in your own hands, and if so you would still have another piece of property on the premises. The danger apprehended by Mr. Wright that you are going to cause damage by your property or accident to life—I am afraid you would hardly be able to avoid that. If there are any conditions arising which would cause danger due to your fault, whether it be in wiring belonging to you or somebody else, you would undoubtedly be responsible for it. Mr. Dion, what would be your views?

Mr. Dion: The company should own, I think, all the primary installation. I do not see how you can avoid that. There is no question that in some cases it may involve you in a suit for damages, especially if the necessity arose for placing transformers inside the premises; as it is, I do not know whether that is being done in this country or not, but I know transformers are being placed in buildings in many places, and still I do not see how you can avoid owning and paying for all the primary installation. I should say that the company's responsibility should cease at the secondary terminals of the transformer.

The President: Still retaining the ownership of the meter?

Mr. Dion: Yes. I would like to sell the meter, but the conditions of meter practice are such, with the necessity of changing meters and that sort of thing, that you cannot very well do it. But, as a matter of principle, we should sell the meter. We should own nothing from the secondary terminals of the transformer inside.

Mr. Woolsey: I might say to the members of this Association that I have been in all the principal cities in the United States, and that the rules over there have been, regardless of where the transformer is placed, (the transformer is generally placed in the scuttle hole in the fore part of the basement, or else above the transom, above the stores or dwellings, or on the side of the dwellings,) that it has always been held as the property of the lighting company, the furnishing of the wires and running them into the building to the point of the meter. They also have a clause in their contract with the companies there that all material used belonging to the company, placed with screws, is always the property of the company furnishing the power; there is also a clause in their laws which says, that in case anything is placed with screws in the building, that is, not nailed, regardless of whatever may happen, and of how the trouble occurs, it cannot become the property of anybody but the person who put it there.

The President: How about the question Mr. Wright raised of the responsibility to the operative company for damage which may be done on the premises to the property of the company? Mr. Wright is speaking from personal experience on that point, I believe, and undoubtedly has good reason for what he says.

J. J. Wright: It is not only the damage, but the alleged damage. It just occurs to me, I have had an elaborate contract drawn up; it is not one that would scare a customer at all, but it has been very carefully drawn, and as a consequence of the study of several clever legal minds to cover this point of damage; and any member of the Association who has a mind to drop me a post card after I get back, I shall be most happy to send them a copy of it; it covers the point most clearly and as completely as it can be done legally. If I had thought I would have brought a few copies over. (Applause.)

The President: The next questions I have are: "Should rent be charged for meters? If so, what would be a reasonable rate?" "Should rent rates for power and light meters be the same?" "Should a higher rate be charged for larger than for small meters?"

J. J. Wright: We charge meter rent on all watt meters. The only kind of meter we use which we don't charge rent for (because it is only used for our own personal guidance), is the Edison electrolytic meter; but all watt meters and mechanical meters are charged rent for, the smaller meters at the rate of 25 cents per month, and the larger watt meter, direct current, at the rate of 50 cents per month. We find it necessary to do so on account of the large amount of repairs these meters take and the high original first cost. The consumers complain in some cases and say that the gas company does not charge for meters. They are thinking now of charging for them, however.

The President: The fact that you charge for it indicates that you think it should be charged for.

J. J. Wright: Yes.

The President: Do you make any distinction between power and light meters?

J. J. Wright: No, about the same price. There is also the government fee to be taken into account in charging for these meters—the government inspection fee of $2, which also has to be paid out of this revenue.

Mr. Anderson: Do you charge meter rent on all accounts?

J. J. Wright: On all accounts where meters are used. There is no absolute hard and fast rule; there are exceptional cases, but the rule is to charge on all accounts.

Mr. Anderson: In our case in Windsor, if the account does not run to $5, I charge 25 cents; as soon as ever it reaches that point I drop the rate; when a meter earns that amount of money I can afford to throw that meter rent off. A meter rent is a very obnoxious charge, as you all know. The customer of course brings up the claim that the gas company makes no charge for meters. We have to meet that with the argument that the electric meter costs about three times what the gas meter does, and is subject to a great many more enemies. But there are a great many cases where it is very hard to charge a meter rent, and where you have accounts running $5, $10, $15, $20 and $30, a meter rent is not worth arguing with the customer for. If you get a meter rent on accounts running under $5 you are getting all that you practically require. The meter rent comes out of the people, I claim, the residential consumers. If you reach those customers by a meter rent, you are practically reaching, I claim, all that is required. Commercial lighting will generally run over $5, so that for commercial lighting we hardly ever get any meter rent; $3 a year is perhaps a pretty fair investment to collect on an $18 or $20 investment.

The President: Do I understand that $5, without rental for the meter, is regardless of the number of lights a customer has? If he had 100 lights and

brought in $5, would that warrant you in dropping the meter rent?

Mr. Anderson: As soon as his account runs to $5 he would pay no rent for the meter. I do not care how many lights he had, as soon as his account ran to $5 per month, I would charge him no meter rent. However, I believe the practice with a great many companies is that they charge on all accounts. In Detroit I find that the custom prevails very much as I speak of. I have followed them very closely, because their rates are similar to ours, and we can always meet the consumer in Windsor by stating that our rates are just as low as they are in Detroit, and that practically cuts off any complaints that we may have. In Windsor we use the Schallenberger meter largely. We charge a cent and one-half per ampere hour, with a discount of from 5 to 33⅓ per cent.

J. J. Wright: You can afford to throw off the meter rent at that.

Mr. Anderson: I do not claim we can do as cheap lighting as Mr. Wright can in Toronto, or Mr. Hunt in London, but still we are not out for doing business for nothing.

Mr. Leyden: I think the proper business principle of running an electric light station is to make every department, if possible, pay for itself. A proper system of accounting should have a separate department for operating and maintenance of meters, and it is possible to make that department self-supporting. For that reason I think it is only fair and right that the customer should pay the rental of that meter, and I think that $3 a year is a very small rental; I hardly believe it will reimburse the station manager for the expense of buying and maintaining that meter. What we usually do here is to fix a meter rental of about 20 per cent. of the cost of the meter for each year, whether it is a small or large meter. Lighting meters usually run about the same price; there is not a great deal of difference between a ten ampere meter and a large meter.

Mr. Hart: On what basis do you arrive at 20 per cent., charged to the customer on the meter as a rental?

Mr. Leyden: I always figure that you have to get about six per cent. return for the money invested, then the depreciation of that meter is easily eight or ten per cent., that makes 16 per cent; then for inspection and any incidental charges, 4 per cent. is a very small allowance, so that 20 per cent. will hardly pay you.

A. A. Wright: Our custom is where we put in meters from 7½ to 10 amperes, we always charge 25 cents a month rental; and as the last speaker says, I believe every department should maintain itself. When you take into consideration the facts that you have to have a room to clean those meters; have to have a man to go around and clean them and look after them; and when you consider also that fire occurs frequently and you lose one or two meters a year, and when you pay for inspection and one thing and another to keep things in order, I don't believe $3 a year is more than a good christian man can stand.

Mr. Leonard: I would like to call the attention of the convention to one matter which slipped through yesterday without creating any discussion, that was this matter mentioned by Mr. Browne in regard to a day load for lighting stations; he proposed an idea which it seems to me is a good one. The idea is this, to help out your day load and even up the curve and reduce the peak in comparison with the other parts of your load, by getting on customers that use power during the day at hours when you have no use for it for lighting. We have made a contract with the Royal Electric Company covering the use of 3,000 h.p. for power purposes, whereby we use the power only during such hours as it would not ordinarily be required for lighting; we have a perfect right to use the power any time during the summer up to seven o'clock in the evening. In the winter months we are obliged to shut down our power at four o'clock, which accommodates the lignting station to such an extent that they can utilize the same apparatus, the same lines and general equipment for power purposes, and then utilize it again in the evening for lighting purposes. I don't think our case is any different from the case of many others, and if our users had this thing presented to them in the proper light, I believe that a large amount of business could be obtained by local lighting companies in this way. It is a fact, I think generally recognised, that there is very little work done in a shop after the lights are lit; the quality of the work is inferior. I think we notice that in connection with cotton mills particularly. I am referring in this case to 3,000 h.p. in connection with the Dominion Cotton Mills Company of Montreal. Now, small manufacturers and such institutions as that would regulate their hours of work so as to enable them to use this cheap power, which, perhaps, they could not afford to use at the higher price they have to pay for it if they use it when it would be required for lighting. Lighting companies, on the other hand, can afford to let power under those conditions very much cheaper, because the same generating capacity and station equipment, as well as the lines, are utilized so as to make a double earning capacity. I would like to hear other opinions in regard to this, and create a little discusion on the subject.

Mr. Leyden: In connection with Mr. Leonard's remarks, I might say we have made quite a number of contracts here for power on the basis of which he speaks—that is, during certain months in the year, from the 1st of October to the middle of March; the customer agrees not to use power after half past four or five o'clock. Here we are a little differently situated to what they are in Montreal, in that the city time is about half an hour beyond the standard time; that is, the sun goes down here twenty odd minutes later than it does in Montreal, so that we carry our contracts about half an hour further on than they do in Montreal; but I find comparatively very little difficulty in persuading manufacturers to accept this method of buying power, because, in the first place, there are a great many manufacturers that shut down during the winter for a couple of weeks to take stock, and nearly all the manufacturers are running comparatively light during those months. The manufacturers here in town are largely iron manufacturers, and it happens, fortunately for us, that their light season is in the winter. While a great many have objected strenuously to the idea when it was first broached to them, when you have explained to them all the workings of the thing and the advantage on both sides, and the advantages of a cheaper rate for power, because you can make a very marked difference in your rate for power, taking all the advantages into consideration, it is not a very difficult matter to get them around to your way of thinking. We have made quite a number of contracts on that basis.

Mr. Dion: May I ask Mr. Leyden how he controls that. Have you separate circuits for them?

Mr. Leyden: We have to trust to their shutting down at the time the contract calls for. We have a strongly worded contract; if they use it beyond the contract we have the privilege of charging an extra price for what they use.

Mr. Gossler: In reply to the inquiry of Mr. Dion, I might say we have quite a number of contracts that apply to power users after four o'clock, and relying upon their honesty, it is comparatively an easy matter to determine when they do or do not use it, because we know the circuits they are on. This matter of using power before four o'clock, I presume, has been carried out a little further in Montreal than in any other town in Canada, at least, to my knowledge. And I may say that last winter, at the time of our very heaviest lighting load, our day load represented about 75 per cent. of the very highest peak load that we had at first. I think that was rather extraordinary, at least from the records I have been able to obtain, and at present our day peak load is very considerably beyond the peak load at night.

Mr. Noxon: I would like to ask these gentlemen who have had experience with the day load whether they have many requests from parties using power for running extra time, or an amendment to the arrangement to allow them to use it after four o'clock, which would materially affect the business of lighting? Because I infer that many manufacturers having made that arrangement would, at certain seasons of the year,

find themselves hampered during a rush of business by having to shut down at four o'clock.

Mr. Leonard : I think I can give you an idea that will clear up what you have in mind, and relieve you as to the matter of interference of the two loads. If the contract provides that the manufacturer close down at four o'clock, I don't think there will be any difficulty in getting the load back again by 7 o'clock, and at 7 o'clock you have generally passed the peak of your load ; after those hours anything you can get is very welcome.

The President : I think, perhaps, I can assist that a little further by a personal example. We have one case of about 450 h.p. where their contract provides that they shall have the privilege of using about 450 h.p. during twenty hours of the day, and during the other four hours of the day the maximum of their requirements shall be 300 h.p., thereby getting about 33⅓ per cent. of their capacity in consideration of that reduction. By that means they get a very much lower rate for their 450 h.p. during the twenty hours and 300 h.p. during the four hours than they would otherwise be able to get, for the reason that the company would be obliged to get the full return on the 150 h.p. that was cut off as if they sold it in light, consequently the power consumer would have to pay a very high price.

Mr. Noxon : I would merely ask if this phase of the business would be advisable. The reason I ask this is, because we are proposing to go into furnishing power by making a contract. Would it be advisable in making a contract, provided they wanted to use the power continuously, which of course would be an object, to stipulate that we would make a provision that the hours from four to eight should be entirely exempt in any case ; that they could use the other twenty hours in any way they wished.

Mr. Leyden : That is a form of contract we use.

Mr. Wyse : I would like to ask Mr. Gossler if his day load is equal to his peak load in winter ? I understood him to say that his day load was equal to or greater than his peak load at night ; does that apply to the peak load in winter.

Mr. Gossler : If I remember correctly, I think I said that our day load last winter at the time of our very heaviest load was approximately 75 per cent. of the night peak load. Next winter we expect to be in excess of the night peak load.

Mr. Reesor : Mr. Leyden said a minute ago that it would make a material reduction to a customer. I would like to ask how much reduction do you propose to make between a customer that uses it from 7 to 6 and one that uses it from 7 to 4 in the afternoon.

Mr. Leyden : I don't know that I can give you any positive figures, but I figure it would be about 25 per cent. difference. It makes a very great difference to you. You can figure about how much your full capacity is, so much horse power delivered. If you can sell it twice, if you get 75 per cent. of the value of it for each time, you are getting 50 per cent. more than you would in the rates, taking it the other way.

Mr. Reesor : If a customer says I want 50 h. p., and I will agree to take it from 7 to 4, what percentage would you say ?

Mr. Leyden : 25 per cent., at least.

The President : In my address at the opening of the convention I took occasion to refer to this, for the reason that I regarded it as being probably the most important question for operating companies. In answer to the question put to Mr. Leyden just now as to the difference between the man who would use up to four o'clock in the afternoon, and another one who would require to use up to six, you can arrive at it by determining how much revenue you would get out of that amount of power during those two hours from lighting. Lighting during those two hours is a necessity, you can't get along without having the light ; therefore, assuming that you can sell electric lighting, how much revenue can you get from the lighting for those two hours out of that amount of power ? Having determined how much revenue you want from the power for the entire day, you will be able to know how much you can afford to get out of it during those two hours of lighting, and the balance devoted to selling the power at a cheaper rate. In other words, you have a given plant out of which you must get a certain return ; that certain return for lighting only must come out of those two hours. If you can get that return, plus 50 per cent., by selling the power during the rest of the day, outside of those two hours, evidently you can afford to sell that power for only 50 per cent. of what you get for the other two hours. I will now ask Mr. Plews to read his paper, entitled, "The Protection of Low Tension Wiring against Dangerous High Potential Currents." It is a short paper, but it is on a subject that is very likely to engage your attention very thoroughly, and it will, undoubtedly, call for a considerable amount of discussion. In order to assist Mr. Plews in the demonstration of his paper, and to enable him to answer any questions you may wish to put to him in a way that will appeal to you, Mr. Wickens has kindly loaned us a blackboard which we will have set up before you, and Mr. Plews can mark his diagram on that.

Mr. Plews then read his paper. (See page 162.)

The President : This is perhaps the most important paper that we have had for some time ; it is one that interests us all very keenly, and we must very highly compliment Mr. Plews if he has accomplished successfully the device which he has set forth here. It is something that should be immediately put into service if it is one that can be relied upon to accomplish what he says, and we certainly thank him very highly for bringing it to our attention.

(Mr. Plews at this point drew a diagram on the blackboard illustrating the apparatus described in his paper, and by means of it answered many questions which the members asked as to the method of use, its reliability, etc.)

The President : I think the most cordial thanks of this convention should be extended to Mr. Plews for exploiting what he has done so far, and even if it be not complete, it certainly is a step in the right direction, and we should certainly assist him all we can to accomplish the results desired, without introducing other elements of danger. I move that the thanks of the convention be extended to Mr. Plews. (Applause.) Now, we will hear from Mr. Leonard.

Mr. Leonard read his paper, entitled "Transformer Economy." (See page 154.)

The President : Gentlemen, it is too late to undertake any remarks to-night on this paper, but I think I can say that it is one that every one of us can take home when we get the printed form, read it over carefully and attentively, study it, and bring it to the attention of our associates in our companies. It strikes the key note of one of the most important economies of central station operating. I hope that to-morrow morning, after the election of officers, upon the resumption of the papers you will be prepared to take up the discussion of this paper thoroughly.

The convention adjourned at 4:45 p.m., to reassemble on Friday morning.

At 5 p. m. the members and friends were privileged, by courtsey of the Hamilton, Grimsby and Beamsville Electric Railway Co., to enjoy an excursion over the company's lines, 21 miles in length, traversing one of the most picturesque and beautiful districts of Canada. On returning to Hamilton a visit of inspection was made to the terminal station of the Electric Light & Power Co.

THE BANQUET.

Upwards of one hundred members and guests participated in the annual banquet. It was the first event of the kind held in the handsome dining hall of the New Royal hotel. The menu, as well as the service, displayed the skill of the management. The President, Mr. W. H. Browne, discharged in an acceptable manner the duties of chairman and toast master. The following gentlemen occupied places of honor : His Worship, Mayor Teetzel, Hon. J. M. Gibson, Hon. Mr. Shepherd, United States Consul, ex-President J. J. Wright, President-elect A. A. Dion, Mr. A. F. Pirie, ex-president A. B. Smith, Mr. Fred Thompson, Mr. John Moodie, Mr. John Knox, Mr. John Patterson.

The following toasts were duly honored: "The Queen," followed by the National Anthem; "Our Association," responded to by Mr. J. J. Wright, first President of the Association; "Our Guests," replied to by Col. Shepherd, U. S. Consul; "Our Rights and Wrongs," response by Mr. Stephen Noxon, of Ingersoll; "Hamilton, the Electric City," response by Mayor Teetzel; "The Press," response by Mr. A. F. Pirie.

The proceedings were further enlivened by excellent instrumental and vocal music.

THIRD DAY.

The convention resumed at 9.30 a.m. President Browne called the convention to order, and said: Before proceeding to the normal order of business, I have a telegram which should have been read at our entertainment last evening. It is as follows:

"OTTAWA. For Banquet to-night. Report passengers carried by electric railways in Canada last year reached the 100 million mark. George Johnson, Statistician."

The President: The first business we have to attend to this morning is the election of officers, and for the office of President the Nominating Committee has mentioned the name of Mr. A. A. Dion, of Ottawa. (Loud and prolonged applause.) After that it is not necessary for me to ask for any other names. I think I can safely say, with the approval of the convention, that Mr. A. A. Dion will be our next president.

Mr. Dion was declared elected to the office of President.

The President: The Nominating Committee has offered for the position of 1st Vice-President the name of Mr. Geo. Black, of Hamilton.

Mr. Carroll: I have much pleasure in presenting the name of Mr. E. E. Cary, and in doing so call for a ballot. I think we need young blood and active workers in the Association.

The President: Mr. Carroll offers the name of Mr. E. E. Cary.

Mr. Leonard: I think I can heartily approve of the name Mr. Carroll offers, and of the suggestion that we need young blood; and while we all appreciate Mr. Black, those of us who enjoyed the hospitality of the rear end of the room last evening cannot help but feel that there is a possibility of a whole lot of young blood being proposed or offered by Mr. Cary, and to the intent that we may receive the sense of the Association in that matter I have pleasure in seconding Mr. Carroll's nomination.

Mr. Black: Will you allow me to withdraw from nomination. I would like to see the nominations go in unanimously. My nomination was a surprise to me at the time; I was not in the room yesterday when the committee reported, and if you place Mr. Cary in the position of 1st Vice-President you will have a good man there.

Mr. Kammerer: As Mr. Black, who is my choice as first Vice-President of this Association, has seen fit to withdraw, I desire to say a few words. The Canadian Electrical Association is an association of central station men, telephone men and telegraph men, and as such I cannot support Mr. Cary. Mr. Cary is a supply man; I am a supply man, and I think we should not take a leading part in the principal offices in the Canadian Electrical Association. As members of the Executive Committee, it is all right; we serve our place in that way, but as I said before, it is an association of central station managers, of central station people, of telephone people and telegraph people; let them take care of it, let the supply men step down and do the entertaining if you like; that is what we are here for. I have much pleasure in nominating a central station man whom I think you will all join me in saying is a good bright fellow, and that is Mr. Noxon, of Ingersoll.

Mr. Carroll: I think those remarks come with ill grace from our friend, Mr. Kammerer, for this reason, that he has been on the board himself, and he is a supply man; and I have been on the board myself nine years and I am a supply man.

Mr. Kammerer: I think our friend Carroll has misunderstood me. I spoke with reference to an executive officer of the Association—president, 1st vice-president, or 2nd vice-president. As members of the executive, board I distinctly stated I would like to see supply men on it

Mr. Leonard: I think Mr. Kammerer is making a wrong assumption when he assumes this is an Association of telegraph, telephone and electric light men. I think that the supply men, perhaps, make the largest contingent that we have with us, and if it was not for the support and strength the Association receives from the supply men, I think we would have a very uninteresting and very small society. Supply men have, of course, personal interests to work for, but I do not think that there is any member here who is in the supply business who would be elected to an office such as the first or second vice-president of this Association and would so bemean himself as to work that position for his personal benefit or for the benefit of his company. (Hear, hear.) I firmly believe that this Association should be run in the interests of central stations, and what is the interest of the central station is the interest of the supply man. Of course, we have heretofore had a number of central station men, representative men who have the management of the largest stations in the country, and it is difficult, I think, for some of the smaller central station men to fill this position so well as some of our supply men. The largest central station men have had their turn. I think now it is about time to give the supply men a chance, and see what they can do. Let us try it once.

Mr. Higman: I would say that the original intention, so far as I understand the matter, was that this Association should include all branches of applied electricity, and I have heard complaints made within the past year or two that there has been a tendency to make it wholly an electric lighting association. Personally, I have no objection, but if we are to maintain that broad character of the Association, I think we should keep in touch with the other branches, and personally there is no one in this room to-day whom I would sooner see in the office than my friend Mr. Cary. Those are my sentiments. I think we should try and keep the broad lines of the Association, and include all of them in its management.

Mr. Bonner: I would like to ask a question. If it were not for the supply men, how long would our good friends in the lighting business and in the telephone business and in the telegraph business continue in business, or when would they have gotten into business? If they are so dependent on the supply men in a business way and for the furtherance and improvement of all their interests, why can not the supply men serve an Association of electric light, telephone and telegraph men in the same manner? I think the whole thing works in together; we are interested alike for one common purpose, the improvement and success of the business as a whole, and why should we not work together in our Association?

Mr. Woolsey: As far as I am concerned personally, I have no objection to Mr. Cary's appointment as vice-president, but from years of experience in the electric lighting field among the various associations connected with it in different parts of the country, it has been found that the election of supply manufacturers or their employees, or the manufacturers of apparatus, as officers, from the president down to the secretary and treasurer, has never been found to the advantage of the Association itself; it has been tried time and time and again, and especially four years ago in the State of New York, it was tried to the detriment of the association—not that the men of the supply department or the manufacturers are not men who are responsible and capable of holding those positions, but it was found to be a detriment. The people in connection with lighting companies are men who are just as intelligent as the men who are representing manufacturers. I believe we can find to-day men amongst those who are representing the electric light companies who are as capable as we to fill those positions, and it is no more than right that these men be given the privilege before the men outside are taken in. It is well enough for us to take a part and to assist in every possible way, but as to our taking an active part in these offices, I think it is entirely wrong.

Mr. Dion: I Wish to say that I am sorry this question was raised at all. Until now I think the question

of a division between supply men and central station men was never raised. I think it is a mistake to raise it ; this Association is not old enough or large enough to draw any lines between any classes of members; we want all the members, we want their assistance, we want their work. This association has two principal objects, one is the furtherance of the interests of the companies which the members represent generally; the other is the acquirement of knowledge in our calling. We know that for both of these objects, and especially for the last one, we have to depend in a very large measure on supply men. The papers which are read here and which contribute so much to the increase of our knowledge, are generally the result of the study and experience of men engaged in manufacturing, or the supply men. Then if you admit that we owe a considerable part of our success and the success of our Convention to the efforts of the supply men, if you put them on your committees and get them to perform the work of the Association as they have done, some of them in such an efficient manner, is it right to debar them from the only little reward we can offer them in the way of honors? I do not think it is fair ; undoubtedly it would be wrong to allow men, if they must be considered apart from the other members as a class, to control the affairs of the Association to the exclusion of the station men. There is no question that that would be wrong, but I do not think there is any danger of that for some years to come at least, and in the meantime I should like that we should forget that there is any division between us whatever. (Applause.)

Mr. Bonner: I should like an opportunity to qualify a statement I made to this extent. It is possible the members here may have understood or inferred from what I stated that I had an impression that station men and telephone men and telegraph men were not as equally capable of developing the business as supply men; that was not my meaning at all. It is simply this, that we are in the business of supplying apparatus, and even so, we are at the same time greatly dependent upon the station men to give us ideas regarding the practical effect or operation of what we supply, and to that extent we are dependent upon them, but it is simply the working together of the two interests that makes us, as I feel, equally interested in the success of this Association.

Mr. Kammerer : While it may not be written in the laws of the Association or in the by-laws of the Association that supply men are not competent to hold the position, yet it is the unwritten law, and one in which the older members that are here now will bear me out in (I refer particularly to Mr. Yule, Mr. Black, Mr. J. J. Wright and Mr. Thomson), that it was always understood to be an Association of central station managers, telephone people and telegraph managers, and those actively interested in that business, and not of supply men. While Mr. Dion says he has never heard the question raised before, I may say I have attended the Association since 1892 I think eight or nine meetings —and at three of those meetings I did hear it mentioned and discussed, and finally settled with the old members, that it was not the thing for supply men to hold the position of president or first or second vice-presidents.

Mr. Yule : Mr. Kammerer was vice-president one year himself.

Mr. Kammerer : Let me set you right there. At the time I held the position I was proprietor of a central station.

Mr. Carroll : I would like to say this, that that sentiment has really crippled our Association to some extent, and you have crippled your telephone interests and your telegraph interests by just such remarks as those from Mr. Kammerer. Why should we draw the line between the telephone and telegraph and central station and the supply men ? What he says sounds very nice, but it does not follow out in the history of this Association. I have been a member nine years and I know the history of it. You have crippled your telegraph interests and your telephone interests, and if you continue on with your supply interests you are going to have fewer members than you have got here now.

The President : As between Mr. Carroll and Mr. Kammerer, it would appear that the withdrawal by Mr. Black of his name takes out of the discussion the question of distinction between telephone and telegraph men and the supply men, and the nomination of Mr. Noxon leaves the question entirely between central stations, electric lighting stations and supply companies. Mr. Black has withdrawn, therefore I think any further reference to the question of telephone and telegraph men has been taken out of the discussion by Mr. Black's own action. The situation would now appear to be as between the supply department and the operators of electric lighting stations.

Mr. Higman : I think it is a little unfortunate to make that division. I would lose sight, if possible, of the occupation of those who have been nominated—I would not say it was between the supply men and electric light men.

The President : I will accept Mr. Higman's correction. The idea that I had in mind was that Mr. Black, by having withdrawn his name, took out of the discussion the question of telephone and telegraph interests, but Mr. Higman is correct in saying that it is not a question between supply men and electric lighting companies, but it is a question of having all interests represented. Therefore I will withdraw my remark.

Mr. Leonard : I move we proceed to ballot.

Mr. Noxon : I feel it a great compliment to have my name mentioned in connection with the Vice-Presidency of this Association, but I hope further that my nominator will do me the justice—do me the kindness, at any rate—of withdrawing my name from connection with this position. I certainly would feel that I would be under great obligation to the Association were my name acceptable to them in that capacity to serve to the best of my ability, but at the same time I do not feel that I have any claim whatever upon the consideration of this Association for such an honor as that, and I would therefore kindly ask my nominator to withdraw my name from the convention altogether.

Mr. Gossler : I second Mr. Leonard's motion to bring the question to a ballot.

Mr. Carroll : I cannot see how you can have any ballot, as there is only one name before the Association; Mr. Noxon has withdrawn his name.

The President : I cannot agree with you ; Mr. Noxon has only asked that his nominator withdraw his name, but Mr. Noxon has not withdrawn himself. Before I put the question I desire to know if there be any other nominations desired to be proposed for the office of 1st Vice-President ?

A. A. Wright : Will you allow me to draw the attention of this Association to one thing—that this tempest in a tea pot has not been raised by central station men.

Mr. Anderson : Mr. President, I am only a new member of this Association ; this is the first convention I have attended ; I have never heard of the jealous feeling that is said to exist in this Association. I wish to endorse what the last speaker said—I do not believe it comes from the central station men. I regret very much that the remarks have been as pointed as they have been. Perhaps I may strike the key note when I say it may arise from a little jealousy on the part of the supply men, because I do not believe it arises from the central station men. As far as the success of this Association is concerned, it depends largely, sir, on the manner in which we hold together. As far as the supply men are concerned, I think they are linked together with the central station men, and we cannot deprive them of their right as members of this Association to hold office and get part of the honors, while I believe it would be in the interests of the Association to divide these honors fairly and equally. I just wish to express my sentiments in this way, that in union is strength ; do not let these jealousies creep into our Association and thereby injure it. There is no supply man on the floor but what I would welcome and be glad to see hold one of the offices of this Association. My acquaintance with Mr. Cary is limited, but I think he would make a splendid man for the position, and as a central station man I have no hesitation in supporting any supply man for one of the vice-presidencies of this Association.

Mr. Kammerer: One word. My motive has been questioned by Mr. A. A. Wright, of Renfrew. My motive was to carry out what the Association was originally intended for and started for, and I challenge Mr. Wright to prove or to say that I am not right in what I am contending for this morning.

Mr. Carroll: I challenge him, for he was one of the officers, and was a supply man at the time. (Cries of question, question.)

A. A. Wright: I suppose I have the right of reply to Mr. Kammerer.

The President: You have the privilege from the President of replying.

A. A. Wright: I do not want anyone to think that I was casting any slurs upon Mr. Kammerer, but I merely wished to draw attention to the fact that central station men were anxious to have this thing run evenly, smoothly and nicely, and I believe Mr. Kammerer is acting in good faith and is speaking what he believes; I do not doubt it in the least. Whether he is right or wrong is a matter for us to decide when we vote, and it is not necessary for us to go into this thing particularly, but vote as we like and have no disturbance.

Mr. Carroll: There is a second nomination for 1st Vice-President; I have not heard it seconded.

The President: I was not aware it required to be seconded, but that there may be no question——

Mr. Thomson: I second it.

The President: Before I put the question, I desire to say, the position of the President in this matter is rather different from what it is on matters ordinarily before the convention; and I hesitate to make any remarks whatever, and will absolutely refuse to express my opinion pro or con. On everything else except the nomination of officers I, during the time that I have been and will be President, propose to have my say, and I think I have exhibited that tendency in this convention, but I do wish that the result of this vote shall be, not the creation of any ill-feeling, not the creation of any severance, but the cementing together of all the interests belonging to this Association. (Applause.) I would have preferred that the candidates for this office should have been confined to one name, or if there must be more than one name, several names; and I was rather pleased when I found that Mr. Black had been proposed by the Nominating Committee, and that Mr. Cary had been proposed by independent nomination. The issue would have been better for all of us if Mr. Black, Mr. Cary and Mr. Noxon had been offered for our votes, but as Mr. Black has withdrawn, the question is left for you now to decide as to whether you believe it is desirable in the interests of the Association that a man who is representing an operating company, or a man who is representing a supply company, both of them personally very popular men, shall represent the interests of this Association in an official capacity. Now, gentlemen, the ballot will be taken by each one writing the name of his candidate upon a piece of paper, and I will appoint as tellers Mr. Black and Mr. Anderson. Associate members are not entitled to vote, therefore when the tellers pass around and receive the ballots of each one, you will kindly see that they are active and not associate members. Gentlemen, in order to facilitate our progress this morning, while the tellers have your votes for 1st Vice-President before them for consideration, we will take up the question of the election to the office of 2nd Vice-President, and the name presented by the Nominating Committee is Mr. P. G. Gossler, of Montreal. (Applause loud and prolonged.)

The President: I cannot find anybody who has got the name of anybody else; therefore Mr. Gossler is 2nd Vice-President. (Applause.) The names presented by the Nominating Committee for members of the Executive Committee, for re-election from the old board, include that of Mr. E. E. Cary, who has been ballotted for for the office of 1st Vice-President. Should it occur that he will have a majority of the votes for that position, some other name will require to be presented for the Executive Committee; therefore I will at the moment offer for your consideration only four names of the old committee: Mr. J. J. Wright, Toronto; Mr. A. B. Smith, Toronto; Mr. Ormond Higman, Ottawa; and Mr. John Carroll, Montreal.

Mr. Higman: I would ask you to withdraw my name; I have been on the committee now for a long time, almost since the flood I was going to say since the formation of the Association —and I would like to give place to somebody else.

The President: Mr. Higman can only give place to somebody else on this occasion by nominating somebody else.

Mr. Wickens: I would like to nominate Mr. Black to fill that position.

Mr. Carroll: While I would like to see Mr. Black on the committee, he has got to go in on the second ballot. Under the constitution we have to elect five of the present board.

The President: I have mentioned the names of only four of the five because Mr. Cary is under consideration by the tellers for the office of 1st Vice-President. In order to make the road clear for the election of five gentlemen of the old board, I can announce now the result of the vote for the office of 1st Vice-President: Mr. Noxon has received 26 votes, Mr. Cary 29. Mr. Cary therefore is declared to be, by the choice of this convention at present assembled, 1st Vice-President for the incoming year. (Applause.) Now, therefore, we have to consider for the Executive Committee entitled to be re-elected from the old board: Messrs. J. J. Wright, A. B. Smith, O. Higman, John Carroll, and one other, and Mr. Wickens has nominated Mr. Geo. Black. Are there any other nominations?

Mr. Cary: I would request Mr. Higman to give his consent to serve, because we will be in Ottawa next year, and outside of the great value of Mr. Higman's services in the past, and what I know they will be in the future, I hardly think he realized that we were going to meet in Ottawa, and really we cannot possibly get along without him. I know that from past experience, and if he will only kindly consent to serve I think we will all feel grateful to him.

The President: I didn't take Mr. Higman's remarks in earnest at all. (Applause.)

Mr. Higman: I was going to say that I will serve in any case whether I am on the committee or not. My idea was to give a chance to those who had not had the opportunity hitherto, but if it is the desire that I shall remain on for this year, I certainly will.

The President: Then the names presented to you now are: Messrs. J. J. Wright, A. B. Smith, O. Higman, G. Black, and John Carroll for the Executive Committee consisting of five members to be re-elected from the old committee. (Carried, amid applause.) Now for the five other members of the Executive Committee. And right here, gentlemen, I want to say that, with the exception of Mr. Carroll, Mr. Kammerer and Mr. Wickens, you seem to have forgotten the fact that everyone of you are entitled to nominate somebody else if you want to, and in this case I want somebody else to nominate another fellow. The names presented by the Nominating Committee are: Messrs. D. R. Street, Ottawa; A. Sangster, Sherbrooke; J. F. H. Wyse, Brantford; B. F. Reesor, Lindsay. Now for the last name on this list I want somebody to substitute another for, and that is Mr. Browne, of Montreal. As Mr. Higman said, Mr. Browne of Montreal can be of some value to you if he is not a member of the Executive Committee, and I think from what I know of him he would be really of more value to you if he was not on the Executive Committee, because he has not very much time to devote except in an entirely unofficial way. When I can give the time I can give it and will give it, as I have in the past, freely and willingly, but for official occasions it is not always convenient for me, therefore I ask somebody else to nominate someone in my place.

Mr. Wyse: With all due respect to your request, Mr. President, I think it is to the benefit of this Association that this Association take your request as you took Mr. Higman's, not at all in earnest.

The President: And as Mr. Higman did, I will do likewise. (Applause). It is so much a matter of course and so much the regular thing that the nominating committee omitted to put on this document any officer or any name for the position of Secretary-Treasurer, and I, following their example and realizing that there was no other thing to be settled, forgot to say that we had to elect somebody for the position of Secretary and Treasurer.

(Cries of "Mortimer." Carried amid applause.)

The President: It was not necessary to put it on paper.

Voices: "No." (Applause.)

The President: We have but a very short time left to us this morning, and I suggest, if it meet with your approval, that instead of discussing Mr. Leonard's paper now, that we have read first the other two papers that are stated on our programme, and if we have time then we can discuss all three of them practically as one. While they are not of the same kind or character, yet they all refer to the technical line of our business. I would like to have nearly a day and a quarter left to discuss Mr. Leonard's paper, and I have no idea how much time I would like to have left to discuss Mr. Cary's paper, and I am sure as far as Mr. Turbayne's paper is concerned you will all employ the next few weeks in discussing amongst yourselves the value that it represents to you as operating men, because I presume that in the very near future the question of long hour burning arc lamps will be the most practical one we will have to deal with. I will therefore ask Mr. Cary now to read his paper on the incandescent lamp.

Mr. Higman: Before dealing with the system of arc lamps, I would like to place a resolution before the Association so that it will go in with Mr. Leonard's paper. During the last few years our officers have been greatly bothered to arrange settlements between electric lighting companies and municipalities in respect of arc lighting. Frequently—too frequently, indeed—the contract is made in the terms of "candle power," a lamp of 2000 nominal candle power. That may mean something or it may mean nothing; I am inclined to the latter view of it, because it is extremely hard to determine the actual candle power of an arc lamp; it is dependent on so many things; so many conditions of the lamp when it is in operation arise that it is almost impossible to make a correct measurement of the light. There is the angle at which you take the light to be considered; there is the purity of the carbons, the mechanism of the lamp and several other things, the length of the arc and the time that the measurement is taken. And you all know that it is almost impossible to get a correct measurement of the candle power. So that in those cases where "candle power" is stated in the contract, we have been able to give little or no assistance. In other cases where the contract has been made in the terms of volts and amperes, we have been able to do something. I might cite a case. In Toronto a couple of years ago the municipality retained something like $18,000 of the company's money under the plea that they were not getting what the contract said they should get. After a good deal of wrangling I was called in by both sides, and after testing the various circuits and a large number of lamps, and travelling all over Toronto for a couple of nights until daylight, I made my report, and found that the company was not only fulfilling its contract, but had been supplying 25 per cent. in excess of what the contract called for. This was borne out by the measurements that had been made by the city electrician, whose report or statement they refused to accept. Now, the consequence of that report was this, that the $18,000 was paid over the next day. So you will see, if we have a means whereby we can determine what is being done, it will work out to the advantage of the electric lighting companies. I might say in passing, that at Ottawa at the present moment there is one of these disputes going on. The erudite city solicitor there has stated that a nominal 2000 candle power lamp means an actual 2000 candle power lamp. How he makes that out, I leave him to determine. The resolution I move is practi-

cally the same as was adopted by the National Electric Light Association of the United States, and it has been found to work well there during the last four years since the arc lighting came into vogue.

I will move, seconded by———

"Recognizing the difficulty, if not impossibility, of measuring with any degree of accuracy the illuminating power of the arc lamp, and the great necessity for a more precise definition and statement of the obligation of the producer of electricity for illuminating purposes to the consumer thereof, be it resolved, that in the opinion of this Association, what is ordinarily known as a two thousand candle power arc lamp is one requiring on the average four hundred and fifty watts for its maintenance, the measurements being made at the lamp terminals, where no sensible resistance is included with the arc. In case such resistance is used, it must be excluded in the measurement."

Mr. Henderson: I second that motion; I think it is a move in the right direction.

Mr. Gossler: I would like to ask if that resolution is not just a little incomplete. The advisability of placing more lamps on the street of a smaller candle power is very seriously considered in many large cities, and in some cities has been adopted, and to simply confine this to the 2,000 candle power lamp I think is a little incomplete. I also think this is a resolution that will stand consideration and deliberation of longer standing than passing this resolution hurriedly in this Association. 450 watts at present seems all right, but I think it would stand consideration. I would not like to see it passed hurriedly.

Mr. Higman: Of course, it will not be obligatory for anyone to adopt that as a means of making their contract, and the 450 watts only serves as a basis; there can be no objection to add a proportionate part of that for any arc lamp. Of course, if the Association were to pass this resolution it would then be a matter for consideration to be determined whether the government should give it the stamp of an Order-in-Council, so that our men might act with some standing in the matter. I am quite willing to let it stand as a notice of motion until next year.

Mr. Thomson: 450 watts straight current will give more light than 450 watts alternating current. I believe, according to the measurements, there is at least 200 candle power difference between the alternating lamp using the same watts as compared with the straight current, so that in stating 450 watts, it should be stated whether it was straight current or alternating; and there is a lot of difference between the enclosed arc lamp and the open.

Mr. Dion: Since this is a question that, as Mr. Gossler has said, deserves careful consideration, especially as it may form the basis of an Order-in-Council which would go out throughout the country and have to be accepted as law, would it not be better to appoint a committee to make a report at the next convention. It is true it would delay the matter for twelve months, but in those matters it is better to go slow than to make any mistake. A committee of two men could be appointed to consider the matter carefully during the year, and make a report at the next meeting which would be adopted or rejected.

Mr. Turbayne: I think the lamps under the candle power system can be read on the wattage basis, and I think they are.

The President: As I understand the purport of Mr. Higman's proposed resolution, it is not the establishment of a fixed quantity of energy for a defined candle power, but to have this Association give its sanction to the adoption of the idea that candle power as an element of measurement shall be abolished, and that measurement in energy shall be the basis of a contract; and I believe, and I submit it to you for your thoughtful consideration, that if Mr. Higman will modify his resolution in this respect, and instead of referring to 2000 c.p. or to 450 watts, make the resolution to read "that the basis of contracts shall be upon the basis of energy supplied," we can all agree with his resolution immediately. We do not have to appoint a committee, we do not have to wait a year, we can settle the question now; that is, that this Association recommends not only to its own members but to the governmental authorities, that in making a contract for service it shall be upon the basis of energy supplied to the lamp, regardless of what nominal candle power or actual candle power may be, and I request, if that meets with your approval, that Mr. Higman modify his resolution in that respect, and in that respect, if it is approved by us, I think it will undoubtedly form the basis of future contracts with municipalities.

Mr. Dion: While there can be no objection to the motion, altered as you suggest, it would hardly cover the ground. If I understand Mr. Higman right, he refers to contracts that are already made, as well as those to be made.

Mr. Higman: No, you cannot affect them.

Mr. Dion: Suppose he wanted some definition of what a 2000 nomical c. p. lamp meant, so that he could determine———

The President: I don't understand that to be Mr. Higman's idea.

Mr. Higman: No; it is to deal with contracts when they come up in future.

Mr. Gossler: I agree with Mr. Dion, and repeat what I said, that there are so many things to be considered that I do not see how you can make this matter the subject of a resolution to be passed now. When we say "on the basis of energy", where is that energy going to be—in feeding the mechanism or the arc?

The President: Mr. Higman's resolution is, energy yielded to the lamp.

Mr. Gossler: That opens the question right away, where is your energy going to be consumed? You may have one-half of that energy used in the mechanism of the lamp. The object of the lamp is light, not having the energy consumed in the mechanism. I don't see how you can make this the matter of a resolution to be passed hurriedly. It means an awful lot of trouble if you do, in my opinion.

Mr. Noxon: I quite agree with the last speaker, and also with Mr. Dion, that it would be far better to leave this matter over and have whatever is done done upon such a basis that there will be no injustice in the future. What I would be afraid of would be that any resolution passed by this Association would be taken as authoritative by the government, because this is the highest electrical authority that we have in the country as a body of independent individuals; they would naturally assume that whatever legislation this body made with reference to matters of that kind, would be an indication of the wishes of the electrical fraternity throughout the country, and it probably might be crystalized into law. If that is the case, it is better before such a thing is done that we know exactly the ground we are taking. It may be that it is all right; I am not particularly familiar with it. I am interested in this question from the fact that I am one of the parties having contracts with municipalities, and, of course, you can't get municipalities to understand what is meant by watts; in all their dealings, so far, through the nominal candle power, they have a sort of an idea, although very hazy, what that means; and when you come to get them to accept the thing in watts, a thing they know nothing about, you will have difficulty in convincing the authorities that you are not trying to take some advantage of them.

Mr. Higman: I brought this matter up casually before in Montreal with a view of having the Association take it up. We do not want to interfere or legislate in the slightest degree, but we are called upon to settle these disputes. Now, as a matter of fact, the so-called 2000 candle power gives only from 500 to 700 candle power. It is better to call a spade a spade and not say it is an axe.

Mr. Wyse: I would like to move that a committee be appointed to deal with this question. It is too serious a question to be disposed of by motion hurriedly. It immediately appeals to a central station man; that is, the great advantages of it appeal to the central station men, in the idea that you give 450 watts and receive pay for 2000 c.p. regardless of how that energy is consumed and the amount of light; but, unfortunately, there are two parties to the contract. The other party is the municipality, and what they judge, regardless of nominal candle power or actual candle power, or watts, or anything else, is the amount of apparent light or useful light they get from an arc lamp, and that is going to be their basis of contract. They would immediately inquire as to why the alternating current arc lamp, taking 450 watts, was not giving as much light as the direct current arc lamp, taking the same amount of current; and where you might make that a basis you would have to refer to the apparent candle power represented by a given number of watts, that is, you would have to refer to something that would appear to the people a given amount of light; 450 watts, whether alternating current or direct current, would have to represent to the people a certain amount of light which they could understand or see. I move that a committee be appointed to deal with the question.

Mr. Thomson: I second the motion.

Mr. Higman: I fancy my position in this matter has not been quite understood. I have simply brought it up in order that our inspectors might be of as much use as possible in trying to straighten out the little kinks that electric lighting companies have in many cases; that is the sole object. If the Association is not prepared to take the matter up, I will withdraw the motion and you can take it up at some future time.

Mr. Yule: I remember some years ago Mr. Higman brought this matter up and the discussion was much the same. He recommended then that all contracts that were afterwards made should be made on the basis of energy. We attended to that in Guelph, and had it fixed in that way on the suggestion of Mr. Higman.

The President: I understand Mr. Higman's motion just as he has offered it, I think, that is, he would like to have first determined a measure, approved by central stations in body asssembled, by means of which his employees could interpret not only future contracts, but perhaps present contracts. I recognise that Mr. Higman is in a difficult position because a great many contracts recite that the light furnished shall be of so many nominal candle power. It would facilitate his work a great deal if it were possible to have an expressed opinion from us that a nominal 2000 c.p. arc lamp should not require at the terminals of the lamp more than 450 watts. The point raised by Mr. Gossler that 450 watts may be consumed to the extent of two-thirds in the mechanism of the lamp, and that only one-third shall be applied for useful effect, does not, I think, coincide with Mr. Higman's idea. His purpose, as I take it, is that the 450 watts of energy delivered to a lamp shall be employed by a lamp of the very best character of construction obtainable to-day, so that the maximum of the resultant energy shall be given to the municipalities by the company who delivers 450 watts to the lamp.

Mr. Leonard: Measure the energy across the arc and I think you will get rid of the difficulty.

The President: I take it that Mr. Higman's purpose here is to obtain some defined plane upon which the government, the municipality, the private consumer and the company may meet without any possible chance of error or equivocation; and while it is desirable, as suggested by Mr. Dion, Mr. Gossler, Mr. Wyse and Mr. Thompson, that we be not hasty in determining what candle power may represent in energy, I do believe that we should now support Mr. Higman in some declaration to the effect that energy shall be the basis of calculation on which future contracts will be made, and if possible the basis upon which old contracts may be interpreted.

Mr. Thomson: I believe that 450 watts from carbon to carbon between the carbon points of an arc lamp would give what is known as 2000 candle power nominal, straight current—450 watts between carbon points with a series arc lamp or straight current arc lamp.

Mr. Higman: The difficulty, of course, is not so much that I want to state what the actual voltage of the lamp should be, but that the energy shall be the basis of the contract, so that we may have some ground to stand upon. This matter came up in Chicago in 1893, in an almost similar resolution to this, to make it the standard of arc lighting. There are many reasons why you cannot make an absolute concrete standard unless you eliminate two things; first the quality, that is, the purity of the current, and the mechanism of the lamp; those would not be eliminated in that resolution and consequently we could not make it an absolute standard of lighting, but we are dealing now with the practical question of supply. Assuming that the carbons will be good and the lamps good, if energy under those conditions is applied to the terminals of the lamp, we will get in 99 out of 100 cases the nominal 2000 candle power. But the important point is to bury out of sight for all time the words "candle power" in regard to arc lamps.

Mr. Wyse: I would like to ask Mr. Higman whether he insists on withdrawing his resolution?

Mr. Higman: Or you might refer it to a committee.

Mr. Wyse: That is what I think might be more advisable.

The President: I understand the position now is, Mr. Higman has withdrawn his resolution?

Mr. Wyse: No, he has not; he allows it to stand, and I make a motion that it be referred to a committee, and the motion is seconded by Mr. Thomson.

Mr. Higman: Allow me to move that the committee be comprised of Mr. Gossler and Mr. Thomson.

The President: As I understand the position now, Mr. Higman withdraws his original resolution in the form he presented it, but offers a new resolution in lieu thereof, that the subject referred to in the resolution here proposed, be referred to a committee consisting of Mr. Gossler and Mr. Thomson, who will report to this Association at next convention what, in their estimation, is the best means of meeting the question at issue. Am I right, Mr. Higman?

Mr. Higman: That is the whole question.

Mr. Noxon: Seeing that the convention is practically unanimous upon the main issue—that is, making the energy the basis—would it not be better for Mr. Higman to make his resolution to that effect, and leave the question of what that shall be to this committee?

The President: I will take the liberty of answering that. The committee are now given broader powers than that; that is, they take up the entire question, and they make their recommendation in any particular they deem necessary.

Mr. Higman's motion is presented.

Mr. Yule: I think the gentlemen here do not sufficiently recognize the courtesy they receive from Mr. Higman in this matter. He has brought this up more than once, and is apparently not anxious to take any action but what would meet with the approval of the Association, and I feel he has received scant courtesy.

Mr. Higman: Not at all.

Mr. Yule: We ought to work in with him better than we are doing. I second the motion.

The President: I tried to take away the atmosphere of scantiness of courtesy by endeavoring to interpret Mr. Higman's desires, and I believe the rest of the members of the Association here appreciated the fact that I was interpreting Mr. Higman's intention to deal fairly with this Association and the members of operating companies.

Mr. Thomson: I believe Mr. Higman should be on that committee.

Mr. Higman: Let the mover and seconder be on the committee.

The President: The motion is before you, that a committee be appointed, consisting of Mr. Higman, Mr. Gossler, Mr. Fred. Thomson, Mr. Yule and Mr. Wyse, to consider the question of the interpretation that should be given to the delivery of current for arc lighting and to report at the next convention their recommendations in that respect.

Mr. Higman: Might we not have it "for the purpose of rating arc lamps on a basis of energy"—that would cover the whole thing.

The President: All right.

The motion carried.

Mr. Carroll: Under the head of General Business, I would move that the papers be held as read, and printed and incorporated in the proceedings of this convention.

The President: I object to that emphatically. (Hear, hear.) These gentleman have gone to the trouble of writing these papers for us, and in one instance I know that the chairman of the committee on papers, in order to supply us with papers, took upon himself the task of writing a very important paper; it would be very scant courtesy indeed for us to adjourn now without those papers being read.

Mr. Yule: I move that the thanks of this Association be cordially voted to the Mayor and Corporation of the City of Hamilton, the Press, the Grand Trunk and Canadian Pacific Railway Companies, the Hamilton Street Railway Co., the Radial Railway Co., the Hamilton & Dundas Railway Co., the Hamilton, Grimsby and Beamsville Railway Co., the Cataract Power Co., the Hamilton Electric Light Co., the proprietors of the New Royal Hotel, the Local Committee, and others, for courtesies extended in advancing the interests of this convention.

Mr. Leonard: I second that.

(The President put the motion, which was unanimously carried.)

The President then called on Mr. Cary to read his paper. (See page 160.)

Mr. Cary: Owing to the short amount of time at our disposal, may I request you to allow Mr. Turbayne to read his paper in advance; Mr. Turbayne has written that paper at my special request.

The President: Mr. Cary is our next 1st Vice-President and we will be glad to do anything he asks.

Mr. Turbayne read his paper entitled "Long Burning Enclosed Arc Lamps," (see page 159), which was greeted with applause.

Mr. Cary: In moving a vote of thanks for Mr. Turbayne's paper, I think the members would be interested to know that in response to our President's request upon central station men for subjects upon which they would like papers written, a number of replies were received, requesting a paper on the enclosed arc lamp and its use, and therefore I was particularly anxious this paper should be read. I suppose my turn comes next, and as I have received honor enough from the committee on papers, and as the inner man is entitled to something before we leave, I wish you would kindly excuse me from reading it and trespassing further upon the patience of our members. If there is anything valuable in the paper it is tabulated there in clear form. I am sorry to disappoint my good friend Mr. Gossler, who has his keen knife all ready for me when we got into discussion, but I think it would be wiser to allow the paper to drop.

The President: Some people have suggested that as Mr. Cary is so good natured and so willing, as he always is, to work hard, that he will read this paper on the train on the way down to DeCew Falls, but I hope when we leave here now we will leave to enjoy ourselves. When we leave, our business of this convention will be closed; there will be no opportunity of reopening it until the next convention, and my duties and my opportunity of talking to you as I have just now will cease. I only desire to say in closing this convention that I have not had in all my lifetime's experience, and it has been somewhat varied, as grateful an opportunity of realizing the good fellowship and the thorough-bred honesty of purpose of people who may not always agree with me, as I have found since I have been president of this Association. You took me up last year and unanimously, as you have for my successor, appointed me; it was a surprise, and if I had had time I would have refused. I have tried to do my utmost for the Association, but I have not been able to do all that I should do or wished to do, and I am particularly gratified that my successor is a man who will be able (and if he is not able he will find the opportunity to be able) to fulfill all the duties of President of this Association. I now resign in favor of Mr. Dion. (Applause).

The newly-elected President, Mr. A. A. Dion, took the chair amid applause and said: Gentlemen, I do not propose to detain you at this late hour except to say that I am exceedingly grateful to you for the honor you have conferred upon me. I do not know that I ever did anything to entitle me to this honor, except in taking an active interest in the affairs of the Association, and in being a thorough believer in the usefulness and value of the Association. You can understand that following in the footsteps of Mr. Browne, after what you have seen of him during this Convention, I have not an easy task to perform, if I am to be judged by the standard which he has set. However, you may be assured that whatever little ability or knowledge I may possess will be applied industriously to the interests of the Associotion, and what I may lack in those qualifications I shall endeavor to make up in zeal, and zeal born of a thorough faith in the value of the Association. I thank you very much for the honor you have done me. (Applause.)

Mr. Higman: I beg to move, as briefly as possible, that this Association tender to the retiring President a hearty vote of thanks for the very able manner in which he has filled that office during the past year. (Applause.)

Mr. Dion: Might I be allowed to suggest that we include the names of the other retiring officers.

Mr. Higman: Yes.

The President, Mr. Dion, put the motion, which, on a vote having been taken, was declared carried unanimously, amid loud applause.

The Convention closed at 12.15 p.m.

Friday afternoon was spent as the guests of the Cataract Power Co. in making an inspection of the Company's extensive electric power development works at DeCew Falls.

NOTES.

It was fitting that the two pioneers of electric lighting in Canada, Mr. J. J. Wright, of Toronto, and Mr. Fred. Thomson, of Montreal, should occupy prominent places of honor at the banquet.

Several attractive and useful souvenirs of the convention were in evidence, among them being a nickel plated pocket match-box, having celluloid sides on which appear the name of the Royal Electric Co. and views of the Cataract Power Co.'s generating station; a stickpin surmounted by a miniature incandescent lamp and a union jack in the form of a bow, the gift of the Canadian General Electric Co.; a pen knife and case bearing the name and compliments of the Packard Electric Co.; a diamond-shaped eraser by the Canadian Rubber Co.

The Packard E ctric Co., Limited, of St. Catharines, and R. E. T. Pringle, of Montreal, had their headquarters in parlour K at the new Royal Hotel, where they entertained their friends, as has been their custom in the past. They exhibited a full line of C. P. supplies, including the ordinary porcelain supplies and slate base switches, artistically arranged upon a board, the background of which was black and white. In addition to this they exhibited the new Diamond meter, which is claimed to be correct on inductive load, and a full line of the D. & W. enclosed non-arcing fuses and cut-outs. The exhibit of the latter was the same as that on exhibition in Madison Square Garden, New York, during the Electrical Exhibition in May last.

RECORD OF ACETYLENE GAS PLANTS INSTALLED THROUGHOUT CANADA.

(TABULATED FROM REPORTS SUBMITTED TO THE CANADIAN ELECTRICAL ASSOCIATION.)

Town	Generators. Number installed.	Number discontinued.	Number in use.	Period of Use.	Capacity in Lights.	Number of Accidents.	Advantages.	Disadvantages.	Remarks.
Arthur, Ont.	3	3	0	2 years.	20-16 c. p.	1 explosion.	They have light when required.	Much trouble with Acetylene Gas.	Explosion occurred by gas leaking.
Annapolis, N.S.	1		1		20 lights.				Does not give satisfaction.
Aurora, Ont.	1	0	1	2 years.	40-16 c. p.	No accidents.	Cheapness.	Bad odor. Extra labor in looking after.	Formerly had Electric Light. Imagined Acetylene Gas cheaper. By strict economy costs 75% of Electric Lighting. If used as freely as Electric Light would cost more.
Avonmore, Ont.	1	0	1			Explosion.			Man's hands and face burned. Boy left generator open, caused explosion.
Almonte, Ont.	1	0	1	6 months.	30.	None.	Cheapness claimed, but not as cheap as expected.	People afraid of them, there being so many accidents.	Only a short time established.
Arkona, Ont.	3	0	3	2 years.		One explosion; man badly burned.			These Plants are used here because no other light obtainable except coal oil.
Berlin, Ont.	5	1	4	4 years.	8 to 10 lights	None in Berlin	Better light is claimed.	Strong smell. Danger in handling. Labor and inconvenience in manufacturing.	College authorities gave this matter a thorough test. After using it for a few weeks they threw out the entire Plant, and now use Gas and Electric Lighting for their buildings.
Blenheim, Ont.	4	0	4	Some 1 year; some 2 mo.	15 lights ea.	1 explosion by lighting match where gas had escaped.	Cheaper than electric light.	Think after being in use for some time valves will stick and clog, and probably cause explosions from high pressure. May explode any time from gas escaping when a light is near them.	One man nearly lost his eyesight when the explosion occurred.
Blythe, Ont.	3	1	2	Less than a year.	3 to 6 lights.	None.	Claimed costs half-cost elec. light.	Gives considerable trouble. Costs 1/3 more than electricity and is of short duration owing to cost.	Has been a benefit to Electric Light Plant.
Bridgewater, N.S.	1	0	1	6 months.	12 lights.			Owner would prefer electricity.	Plant is situated about 9 miles from Bridgewater, hence reason for using Acetylene Plant.
Brantford, Ont.	1	1	0	5 months.	20 jets.			Poor light. Machine did not work right.	
Brampton, Ont.	3	1	2	6 months.	10, 20, & 75 lights.	None yet.	Claimed to be cheaper, but not so.	No advantage. Incandescent lamp is far superior. Cost too much and are dangerous.	The people who have the machines are not satisfied with them. Two out of the three generators will not work.
Brandon, Man.	4	4	0	1 year.	20 lights ea.	None.	None.	Dirty, unreliable, costly, etc. (Not sufficient brains to run the machine.) (First-class elec. light system.)	
Brigham, P.Q.	1	0	1	1 year.	5 to 20 lts.				
Carleton Place, Ont.	7	1	6	From 2 mths to 1 year.	20 to 75 lts each; total 350 lights.	None.	Cheaper light.	Very bad odor. Risk of explosion, etc.	Have been told that some who have Acetylene Plants here have since admitted that it is no cheaper than Electric Light. (One of these Plants in Ashton, seven miles from Carleton Place.)
Chatham, N.B.	3	0	3	About 4 mths	30 to 40 lts.	None.	Cheaper than elec. light, for which charge is made 10c per 1000.	Two of the parties also kept Electric Light and have to use it so often that their bill is about the same monthly. Late in evening light gets dim and then they have to turn on Elec. Light.	What is installed in Chatham is no advertisement for Acetylene Gas.
Charlottetown, P.E.I.	2	0	2		10 & 20 lt.	None.	No advantage.	Carbide too expensive.	
Clinton, Ont.	3 and 2 more to be instl'd.	0	3	About 1 year	1-75 lt. 2-40 lt.		Cheapness and good light at any and all times.	One owner of a gas plant informs that it is not as cheap as he was led to believe.	
Coaticook, P.Q.	1	0	1	6 to 8 mos.	20 lts.	None.			
Colborne, Ont.	0	0	0				Cheapness.	Great danger of explosions and damage to property, high insurance rates, etc.	Agents trying to establish Plants here so far unsuccessful. So many explosions in Ontario, people in Colborne are afraid of it.
Cowansville, P.Q.	1	0	1	1 year.	5 to 20 lts.	One.	That it is cheap as coal oil & cheaper than electricity.	Satisfied that it is not as cheap as electricity.	Man got his hand nearly blown off.
Dunham, Que.	1	0	1	1 year.	5 to 20 lts.				
Dundas, Ont.	4	1	3	1 year.		One exploded while being recharged.			Machines are manufactured here.
Dunnville, Ont	0	0	0						Party had one on exhibition for some weeks; unable to sell even one Plant. Natural gas here as competitor with Elec. Light, used through Auer burners.

Town.	Generator Number stalled.	Number continued	Number use.	Period of Use.	Capacity in Lights.	Number of Accidents.	Advantages.	Disadvantages.	Remarks.
Edmonton, Alta.	3	0	3	1 year	30, 30, & 20 lights.		Cheapness & good light.	At times shortage of carbide, and being so far away has caused loss of light for short period.	
Exeter, Ont.	1	0	1	2 years.	20 lts.	Slight explosion.	Cheapness & white light; pay for what used only.	Odor, danger, dust deposit, ghastly light. Attendance, first cost, trouble installing.	
Fenelon Falls, Ont.	2	1	1	9 & 6 mos.	15 or 20 lts.	None.	Can't establish any claims in favor of acetylene gas.	More expensive, troublesome and dangerous.	One party returned machine after 3 mos. use. Wanted Electric Light at price of coal oil, so tried Acetylene for spite.
Florence, Ont.	1	0	1	6 to 8 mos.	50 lts.				
Frelighsburg, P.Q.	1	0	1	1 year.	5 to 20 lts.			Too expensive.	
Galt, Ont.	2	1	1	6 months and 1 year.	10 or 12 lts each.	None.	To get even with the monopolists, the gas and elec. companies.	Users do not say.	1 small Plant is being put in a tavern, which will make 3 installed.
Gananoque, Ont.	3	1	2	1 year.		One explosion caused by looking for leak in generator with lighted candle; man badly burned.	Light on dark days when no current is generated in day.	Cost, bad odor, danger of explosions, time and trouble looking after generator.	One party has come back to electricity. One party uses electricity in his workshop.
Glencoe, Ont.	3	0	3	5 months.		None, although one is said to have had a narrow escape.	That they would be cheaper.	Numerous; when doors of store are opened, the lights are blown out as many as 8 and 10 times in one night when high winds prevail; disagreeable odor from gas escaping.	One of the parties asked my electrician what we would take and put in Electric Lights. They were frozen up for a week during the cold weather.
Georgetown, Ont.	1	0	1	Over a year.	16 lts.	None.	Cheaper than electricity.	Bad odor and dangerous.	
Grand Valley, Ont.	3	0	3	2 years.	20-16 c. p.		They have the light when they require it.	Much trouble with it.	
Grimsby, Ont.	2	0	2	7 or 8 mos.	40 to 50 lts. each.	Explosion in church; burned parson's face.			Don't think they'll last.
Hatley, P.Q.	1	0	1	6 or 8 mos.	20 lts.	None.	Cheapness of light, only means excepting kerosene oil.	No cheaper than Electric Light, dangerous, more trouble and care, and not as sure.	
Holstein, Ont.	1	0	1			Explosion; burned face of young man.			
Ingersoll, Ont.	2	2	0			None.	Nothing said as to advantages.	Bad odor. No cheaper than gas or Electric Light.	Some other contracts taken but not erected. Agents guaranteed too much, probably.
Kentville, N.S.	1	0	1	1 year.	10 lts.	None up to date.	Claimed cheaper than elec. light.	Think parties would not have it installed again.	Firm very jubilant at first, but owing to expense of carbide and danger of explosion, do not say much about it. Electric Company been asked to wire Post Office building to be built this summer.
Louisburg, C.B.	1	0	1	3 mos.			Prefer it to coal oil; no chance to electricity.		Parties talking of putting it in on account of its being cheaper than Electricity.
Lachute Town.	1	0	1	1 year.	40 lts.	One; plumber repairing leak; gas came in contact with fire, causing explosion.	Cheapness of cost of lighting.	Danger of life and property from explosions which may occur at any time.	The party who has this Plant installed narrowly escaped with his life; badly burned about the face. Think Plant will be discontinued.
Lakefield, Ont.	2	1	1	8 mos.	40 lts.	None.		More explosive than electricity.	
Lindsay, Ont.	6	3	3	6 or 8 mos.		None.	Sore heads.	Trouble, expense and risk.	One party who discontinued Acetylene Gas has installed Electric Light; other two who discontinued always had Inc. Lts. User is agent for Acetylene Gas; other users have grievances against Elec. Co.
Listowel, Ont.	2	2	0	4 & 12 mos.		Reported explosion, but denied.	At first better light and cheaper.	Now not so cheap. An everlasting bother and unsafe.	
Londesboro, Ont.	1	0	1		16 lts.			Give considerable trouble.	No Electric Plant here. Gas has been a benefit to Electricity.

Town.	Generators. Number installed.	Number discontinued.	Number in use.	Period of Use.	Capacity in Lights.	Number of Accidents.	Advantages.	Disadvantages.	Remarks.
Millbrook, Ont.	2	0	2	six mos.		One explosion—doing much damage.			Explosion caused while charging machine while in operation.
Madoc, Ont.	2	0	2	3 mos.	20 & 60 lts.	One.	Hotel can have lt. all night. Elec. Plant only runs till 12 p.m.	Higher cost than Electric Light, dangerous, disagreeable odor. Costs more.	Parties regret putting in Acetylene
Morden, Man.	10	4	6	12 mos.	From 20 to 100 lts ea.	One explosion; man's face scorched, also head.		Offensive odor; sooty deposit; nuisance of having to clean out and charge at regular periods. Costs twice amount of Elec. Lt. without counting man's time. Irregular supply of carbide.	
Napanee, Ont.	1	1	0			Exploded first time used; never tried again.		The fact of an explosion which shook a large 3-storey stone building is enough.	
Norwood, Ont.	1	0	1	2 mos.	20 lts.		Claimed cheaper.	Labor in connection with it.	
Orangeville, Ont.	2	1	1	8 mos.			Cheapness.	Danger from explosion.	
Owen Sound, Ont.	0	0	0						One party bought Acetylene Plant, but after enquiry purchaser refused to take it. People here have no use for Acetylene Gas.
Oxford Elec. Lt. Co.	1	0	1	4 mos.	50 lts.	None.	Cheapness and efficiency.		
Parkhill, Ont.	3	0	3	1 year.	100 lts ea.	One; nearly blinded man.	Don't know that any are claimed now.	Trouble keeping pipes clean and generator in good working order.	
Parry Sound, Ont.	1	0	1	2½ mos.	30 lts.	None.	Cheapness.	Unpleasant odor; comparative inconvenience and more or less danger. Light also, although strong, is unpleasantly glary.	
Pembroke, Ont.	0	0	0						People will not use it here on account of reported accidents.
Perth, Ont.	3	0	3	4, 6, & 12 mos.	20, 20, & 60 lights.	None.	Cheap; good light; local control.	Danger of explosion. Disagreeable odor throughout premises; trouble in lighting.	
Prince Albert, N.W.T.	2	2	0		50 & 7 lts.	None.	Less cost.	Dangerous; unclean; destroy goods by smoke. Supplies cannot be obtained when wanted.	
Port Hope, Ont.	1	0	1	9 mos.	10 lts.	None.	Say it is cheap.	No cheaper than Electric Light here, while it is a dangerous explosive and very offensive.	
Rat Portage, Ont.	4	2	2	18 mos.	10, 20 & 40 light.	Escaping gas caused explosion.	Not any; would stop if money were not invested	Trouble of frost in winter. Burners blocking with carbon and fluctuating.	Explosion blew out front of building, which put effectual stop to installations of Gas Plants.
Regina, N.W.T.	2	1	1	6 mos.	60 to 80 lts. each.	None.	Cheap light.	Have to protect generators from frost; generator located in cellar where furnace is. Ins. Co. will not allow this. Burners clog up; require too much attention. Foul smell, which in one case ruined stock of groceries. Plant thrown out.	Electric Light substituted and vendor of plant compelled to stand damages. Adjusted by arbitration.
Sackville, N.B.	1	0	1	6 mos.	25 lts.	None.	Cheapness.	Bad oder, and also that water in gasometer freezes in bad weather.	
St. Mary's, Ont.	7	1	6	1 to 2 years;	10 to 20 lts.	None, but looking for them daily.	Economy, able to light when desired.	Danger, smell, soot, smoke, apt to freeze up, as they nearly all did here last winter.	Claims for economy thought to be false. If Electricity were used as carefully as Gas the economy cry must stop.
Sarnia, Ont.	2	1	1	Few mos.		None.	A refuge when one quarrels with the local company.		
Seaforth, Ont.	4	2	2	6 mos and 1 year.	16 & 20 lt.	None.	Cheaper than elec. light.	Hard on eyes when reading. Amt. of attention and expensive.	Only way to make it cheap is not to burn it. Parties who have discontinued use of gas now use elec. light.
Shelburne, Ont.	1	0	1	5 mos.	10 or 12 jets.	None so far.		Trouble in charging and disagreeable odor.	Not overly satisfied with the gas.
Smith's Falls, Ont.	5	0	5	18 mos.		One or two explosions	Cheapness.	Cost of attention and danger from explosion.	Acetylene people are trying to introduce and push their business, apprehensive that they will injure electric lighting very materially.
Stayner, Ont.	0	0	0						Reports of accidents knocked prospects of Acetylene Gas out.
Strathroy, Ont.	1	0	1	1½ years.	15 or 20.		Have heard of none	Lights not burning sometimes; do not know cause; trouble, inconvenient, bad odor. Some person has to take charge of it.	About 1½ years ago Plant was started for exhibition. Something went wrong with generator, which was taken outdoors, where it exploded.

Town	Generators, Number installed.	Number discontinued.	Number in use.	Period of Use.	Capacity in Lights.	Number of Accidents.	Advantages.	Disadvantages.	Remarks.
Stratford, Ont.	4	4	0						
Stouffville, Ont.	4	2	2	About 2 yrs.		One.		Need much attention; accumulate a kind of coal on the jet, causing them to smoke; very dirty.	
Sussex, N.B.	1	0	1				Cheapness & good for matching colors.	Smoke from burners, which tarnishes; responsibity of looking after; bad odor.	
Sutton, P.Q.	6	0	6	About 1 year.	5 to 20 lts.				
St. Thomas, Ont.	7	4	3	8 mos.		One; attributed to tinkering with hot soldering iron.		Unsafety; unpleasant odor; dirties rooms where used; expense of maintenance.	
Sault Ste. Marie, Ont.	12	0	12		5 to 50 lts ea. total 330 lts; 146 lts. in operat'n.	3; caused by using lighted lamps near generators.	Cheapness.	Strong smell of gas; trouble washing out tanks, cleaning burners; offensive smell; danger having goods near jet. Dry goods merchants cannot dress their windows as is possible with electricity.	Consumers of Acetylene Gas not satisfied.
Thamesville, Ont.	1	0	1	6 or 8 mos.	50 lts.				Uses it just in morning. Uses Electricity.
Tilsonburg, Ont.	6	4	2	11 mos.	10 to 20 lts.	None very serious.	None; sorry they got them.	Too expensive, bad smell and dangerous.	
Whitechurch, Ont.	1	0	1					Complete failure.	Cannot learn cause of trouble. No Electric Plant.
Walkerton, Ont.	4	2	2	1½ years.	30 and 7 lts.		Cheapness, as they do not have to pay for lights not in use.	Dirt, smell, danger and trouble. Do not use it at one place unless the man is at home.	One Gas consumer (discontinued now.) Uses Electric Light.
Wallaceburg, Ont.	2	1	1	8 mos.	50 and 75.	None.	Superior light and cheap.	After burning a number of hours, if not carefully watched, ruins everything in room by emission of fine particles of soot or carbon. Does not admit of fancy window dressing. On account of thinness of gas it leaks through a very small hole, and in consequence smells most offensive.	
Winona, Ont.	1	1	0	2 or 3 mos.	30 or 40 lts.	None.	Claimed to be cheaper.	Much more expensive, not as good a light and very dangerous.	
Waterloo, Ont.	4	2	2	2 years.		Two; not very serious	Cannot say.	Dangerous; dirty; black dust which forms on burners, soiling carpets, etc.	One party tried it, soon had an explosion and threw it out.
Windsor, Ont.	0	0	0						Tried for a time for advertising purposes, then taken out.
Woodstock, Ont.	1	0	1	3 mos.	50 lts.	None.	Cheaper, and can run all night; elec light runs only till 12 p.m.	Go out occasionally. Leave dust and liable to explosion. Freeze up.	
Wiarton, Ont.	1	0	1		12 jets.		Good light.		
Wingham, Ont.	1	0	1	1½ years.	17 lts.	One explosion; no damage.		Cannot depend upon it at all times. Disagreeable and expensive.	Owner of the Gas Plant uses Arc lamp sometimes, and had 27 Incandescent lamps put in in Jan. last.
Woodstock, Ont	5	3	2	2 or 3 mos.		Explosions, but no damage.	Less cost.	Much bother in attendance; unsafe; offensive odor.	
Vancouver, B.C.	sever'l	all n'ly	0	Within a yr.			After being in use a time—none.		Nearly all parties who used Acetylene are using Gas or Elec. Light again. Competition not felt.
Zurich, Ont.	1	0	1			One; blew side and end out of a store; damage over $1000.			
Halifax, N.S.	3	0	3	Eight mos.	2-50 lt. 1-10.		One man pertinently remarked that the only advantage of using this gas is, that no difficulty is experienced in locating a leak in the pipe.	Obnoxious odors emanating from the apparatus. Disagreeable nature of the refuse material. Difficulty in keeping apparatus clean. Continual clogging of jets. Danger of explosion and extreme care necessary in handling and keeping the raw carbide. Decided nuisance. Dazzling nature of ight from gas also objectionable.	Two plants operating successfully. The system has not proved a great success in the vicinity of Halifax, at least.
Dartmouth, N.S.	2	0	2		3-10 light.				

SUMMARY: Total generators installed, 217; number discontinued, 62; number in use, 155; number of accidents, 30.

NOTE.—Data probably inaccurate as to number of generators, discontinued, in use, capacity of lights, period of use, etc.

RESULTS OF THE USE OF ACETYLENE GAS

AS GIVEN IN ABSTRACTS OF REPORTS FROM CANADIAN NEWSPAPERS.

The Erin & Brennan Company appeared in the City Hall, Guelph, last night. An acetylene gas generator exploded during the proceedings, caused by one of the performers passing the generator with a lighted candle, which ignited the escaping gas. Explosion after explosion followed, and some of the scenery took fire. The caretaker had his hands badly burned, and the stage carpet and scenery were scorched.—Brockville Recorder, March 28, 1898.

An acetylene gas generator exploded in a house in Oshawa recently. The machine was blown to pieces, a portion of it making a hole through the ceiling.—Quebec Telegraph, April 23, 1898.

The blowing up of an acetylene generator in the rear of Fuller's cigar store yesterday caused much excitement in the neighborhood. The upper part of the machine was blown upwards, the pipes and valves twisted, the galvanized tinwork dinted, and the west wall of the room singed. There was very little gas in the generator, otherwise the results would have been more serious. The origin of the fire was peculiar. Over the back door of the room where the generator was placed there was an overflow pipe extending out from the building. A match being thrown down ignited the overflow gas, the flame travelling along the tube to the generator and igniting with the larger supply of gas there.—Woodstock Sentinel-Review, April 5, 1898.

Our reporter has just had an interview with Mr. Brick regarding his experience in lighting the Vendome Hotel. Mr. Brick contracted for a 75 light acetylene gas plant. The generator was outside in a separate frost-proof building, partly to meet insurance requirements aad partly to obviate the objectionable stench in cleaning it out daily. After a trial of over three months Mr. Brick has discarded the acetylene gas plant, and has had the entire hotel fitted up with 66 incandescent electric lights from the town plant. He claims that electricity is not only cheaper than the gas, but the objection to the acetylene is its offensive smell and its getting out of order.—Teeswater News, January 4, 1898.

Acetylene in the liquid form is extremely dangerous, but that used in bicycle lamps is not much more harmful than the same amount of kerosene.—Hamilton Spectator, June 3, 1898.

By the explosion of an acetylene generator, Mr. E. H. Morse, dry goods merchant, of Blenheim, Ont., received injuries that may possibly prove fatal. The generator had been leaking for some time, and Mr. Morris went to the cellar to make an examination. Lighting a match, he was examining the joints for a leakage, when the gas exploded with great force, burning his face terribly.—Brockville Recorder, October 8, 1898.

A serious acetylence gas explosion occurred at Cobden, Ont., yesterday evening, as a result of which Mr. A. G. Best had his face and right hand severely burned, and it is possible that his eyes may be injured. Mr. Best was engaged in installing his first plant in Arne's jewelry store, when the explosion occurred. It was caused by Mr. Best opening the carbide chamber and holding a lighted candle over it.—Ottawa Free Press, November 3, 1898.

Alfred Head, of Calgary, N.W.T., was fatally injured as the result of an explosion of acetylene gas, which occurred while he was endeavoring to locate a leak with a match.—Guelph Herald, December 17, 1898.

A serious explosion of acetylene gas took place in W. Nixon's hotel, Avonmore, on Friday last. The carbide chamber of his acetylene gas machine had not been properly closed, and a leakage of gas took place. Before Mr. Nixon could extinguish the light, the escaping gas reached the flame and a terrific explosion followed. Mr. Nixon was terribly burned, and his wife and an employee were slightly injured. The building was also damaged, nine windows being blown out.—Winchester Press, March 30, 1899.

An acetylene gas machine, located in Merner Bros' general store at Zurich, Ont., exploded yesterday, completely demolishing the building. The force was so great as to blow out the east side and front of the building, also wrecking several buildings on the opposite side of the street. The loss on stock is estimated at $1,000.—Guelph Advocate, March 16, 1899.

The acetylene gas apparatus at the Marbleton hotel exploded on Friday, setting fire to the hotel and destroying apparatus. Several persons were badly burned.—Stanstead, Que., Journal.

The new acetylene gas machine lately put in by Mr. W. H. Todd is not giving the satisfaction anticipated.—Stouffville Sentinel, February 3, 1899.

Acetylene gas caused a violent explosion in the Barker House, Fredericton, N.B., a short time ago. The generator was being moved from one part of the building to another, and after the pipes were disconnected and the generator removed, a lighted lantern was taken into the room where it had been, when the escaped gas exploded. The building was badly shaken up and the plate glass windows blown into the street.—Canadian Engineer, February, 1899.

The acetylene gas machine on the premises of the A B. Scott Co., general merchants, exploded yesterday afternoon. The plate glass windows were almost totally wrecked and other damage done. Mr. Scott was slightly burned, and Miss Walls was struck on the head by flying debris.—Toronto Mail, January 6, 1899.

UNDERWRITERS REGULATIONS AS TO THE USE OF ACETYLENE GAS.

The United States National Board of Fire Underwriters have approved of a set of rules for governing the acetylene gas hazard, because of the attempts to introduce acetylene gas as an illuminant in various parts of the country. These requirements provide that the generating and gas holding apparatus, when installed for lighting buildings in the closely built up portions of towns and cities, must be situated in an outside, fireproof and well ventilated building; that bicycle and other portable lamps in which gas is generated and supplied direct to burner should not be approved until such lamps are so constructed that they will cease to generate gas immediately upon the extinguishment of the flame; that the storage of liquid acetylene in any building, or the use of liquid acetylene gas, should be absolutely prohibited; that in regard to the separator and gas holder, it is recommended that only wrought iron or steel, capable of resisting an internal pressure of twenty pounds to the square inch, should be used.

TRANSFORMER ECONOMY.

By F. H. Leonard, Jr., Montreal.

The practical use of A. C. Transformers covers a period of little more than a decade, and yet in so short a period they have been developed into the most perfect piece of apparatus known to the art of electrical engineering. Transformers having a full load efficiency of 98% in the large sizes are not unusual, and in the very large sizes even this high figure is exceeded, and with the best designs the no load losses are less than one-half the full load loss, permitting an exceedingly high efficiency to be maintained over the entire working range.

While the commercial application of transformers is so recent, the principle was demonstrated more than 67 years ago by Faraday, whose investigations gave to the electrical engineer the principles on which are based the science of dynamo-electricity. Faraday in 1812 made a crude transformer, which is identical in general principle and construction with the commercial article of to-day. There are many types and modifications of details, but the commercial transformer of to-day may be simmered down to two general types, known as the shell type and the core type; the once much talked of hedge-hog transformer so stoutly championed by Swinburne having dropped out of the race entirely. There are still strong adherents to both of the first mentioned types. The adherents to the core type of transformer will tell you that the coils are more easily wound and the core itself more easily insulated, that the copper coils being on the outside radiates the heat due to internal losses more quickly. Notwithstanding these seeming advantages to the casual observer, the Johnston & Phillips Co., Ltd., of London, England, who first manufactured this type of transformer from the designs of Gilbert Kapp, after extensive experience with them, abandoned their manufacture aud became adherents to the shell type.

For an equal investment in material and labor it has been demonstrated that with proper design a better transformer can be built of the shell type than of the core type. The double magnetic circuit of the shell type gives a shorter average path for the lines of force, which, combined with a smaller number of breaks or interruptions in the magnetic circuit, call for a less number of ampere turns or magnetizing force, and result in giving the shell type the advantage of a better power factor at light load.

With proper machinery the coil for the shell type transformer can be wound and carefully insulated with but little more trouble than the core type, and the waste in copper in turning the ends of the coil will be no greater than is necessary in the cylindrical coil used with the core type, which touches only at the four corners of the core, which for commercial reasons is made of a rectangular cross section, leaving considerable space inside the coil not filled with iron.

There are many points of view from which comparisons can be made, too numerous for the limits of such a superficial treatise as this, which, generally speaking, favor the use of the shell type, which we believe will be the standard as improvements are made and the results of careful tests are more thoroughly understood.

The sub-division of coils in a tranformer is one of the most important features both as regards the safety of its insulation, owing to the corresponding reduction of potentials between adjacent points, and also as regards regulation. With proper sandwiching and subdivision of coils in both primary and secondary, the drop due to magnetic leakage may be reduced to a negligable quantity, so the drop in voltage as the transformer loads up may be practically confined to what is due to the ohmic resistance in the copper. This is essential, as the regulation of transformers plays a most important part in the quality of service to customers. Good regulation means from 2% in the small sizes to one per cent. in the larger sizes. No one has yet discovered a satisfactory method of compounding transformers so as to maintain the voltage as high at full load as at light load, and as line drop in the primaries as well as in the secondary and inside wiring tend to aggravate and magnify this condition, the importance of guarding against everything tending to drop the voltage will be appreciated, particularly when it is more clearly understood that a variation of one per cent. in voltage will make a difference of about 5% in the candle power of lamps.

Too much importance cannot be attached to hysteresis or the core loss of transformers, which calls upon the generators for a continuous supply of energy to overcome this loss as long as the transformer is in circuit, regardless of the conditions of load being the same when no current is drawn from the secondary as when fully loaded, and if the power factor of transformers is low

the apparent flow of current on this score is greater at no load than at full load. Good transformers should, in the small sizes, not require more than 2% of the full load energy to cover this loss, and large transformers less than 1%.

While the copper loss of a transformer remains constant for any fixed load, throughout its life the core loss—if proper precautions are not taken in the selection of iron and provisions made in the design to maintain it at a low temperature—may increase considerably, often doubling this source of loss in a very short period, and accordingly reducing the all day efficiency, and this increased loss has to be supplied from the central station, for which it receives no income.

From the foregoing hints it will be seen that well designed, modern transformers should give a full load efficiency, depending upon their size, of from 95 to 98% or better, which with good design and proper selection of materials will maintain this efficiency unimpaired.

It is only recently, however, that such transformers could be obtained, and the matter of ageing of the core plates has but recently received attention. It is not more than three years ago that one of the largest electrical manufacturing companies in the United States sold to a large central station, under guarantee of certain efficiencies for the various sizes of transformers covered by the contract, and were obliged to take back every transformer before they had been in service four months, on account of the rapid increase in the core loss, which in many cases, in the short space of time mentioned, had doubled the losses shown in the original factory tests. The iron was taken off the coils and a different quality of iron substituted, which, though not giving quite such good initial results, was able to maintain its efficiency unimpaired, exhibiting no apparent ageing after repeated tests extending over a period of eight or nine months.

By careful experiments with various samples of iron of known chemical composition we have been able to determine which is the best for use in transformer cores, and samples of every lot of iron are submitted for tests for hysteresis loss and for chemical composition. Without such precaution no assurance of results of transformers in service can be secured. Even with the best of iron ageing will take place to a slight extent unless precaution is taken to operate the iron at low inductions, and provide sufficient radiating surface to prevent the transformer becoming too much heated, it having been observed that iron will age much more rapidly when subjected to high temperatures.

As the energy losses in transformers exhibit themselves in heat precaution should be taken to get efficient transformers which operate at a low temperature, obviating the tendency to charge the insulation, at the same time saving the dynamo capacity necessary to overcome these losses and avoiding the ageing of the iron and subsequent augmentation of losses.

Oil may be used in small transformers, and where the losses are large the oil helps materially in radiating the heat. The life of a low efficiency transformer may be considerably increased by filling the case with oil, but this is unnecessary in small transformers of good design. In large transformers of 100 k.w. or more it becomes necessary to use some method of dissipating the heat, as the proportion of radiating surface rapidly decreases as the transformer increases in size, and oil or an air blast becomes necessary even in transformers of over 98% efficiency. We have designed and built 60 cycle transformers of 60 k.w. capacity having a full load efficiency of 98%, which, with only the natural air circulation, have shown a rise of temperature, after 10 hours continuous run at full load, of less than 50 C. This same transformer operated at 125 cycles will run at a higher efficiency with a smaller rise in temperature. Such transformers are rather expensive, however, and where slightly lower efficiency will suffice, an oil transformer can be used at a much lower cost of construction which will give no greater rise of temperature.

Lightning discharges are less dreaded now by central station managers than they used to be. Formerly every thunderstorm brought with it wreck to some of the transformers on the line; this has, however, come to be the exception rather than the rule owing to the substitution of modern transformers, in which the better insulation, together with the greater choaking effect, which follows with higher efficiency and reduced core loss, results in forcing the oscillatory high frequency lightning discharges to take some easier path to equilibrium of potentials. Notwithstanding this, do not neglect to install lightning arrestors, for though the improved transformers offer a more difficult path, yet if there are no lightning arrestors through which these potentials can discharge, the best transformers are liable to be punctured. The suggestion has been made to ground the secondaries or the case of the transformers. Either method makes it safer for the consumer, but both result in greater strain on the insulation of the transformer.

We have had frequent inquiries as to whether the 60 cycle transformers will work on 125 or 133 cycles. A transformer suitable for 60 cycles or 7200 alterations will work better on 125 cycles or 15000 alternations than on the 60 cycles, as the core loss is reduced, though the regulation due to increased magnetic leakage is not quite so good. It is quite the opposite when a 125 cycle transformer is used on the 60 cycle circuit, as in this case the core loss is increased about 30%, and the efficiency correspondingly decreased. If the transformer is not a very superior one, at 125 cycles it is quite likely to overheat, due to the increased core loss at 60 cycles, gradually charring the insulation until it finally breaks down, in the meantime probably showing an increasing core loss followed by further development of heat and bringing about the end at an earlier day.

As the difference between two lots of iron from the same manufacturers may make a difference of ten or twenty per cent. in the core losses of transformers, otherwise identical, it is of the utmost importance for manufacturers to make careful tests of each shipment of iron as it is received, and when this is not done the central station has no protection unless they possess the instruments to make proper tests on the transformers themselves as they are received.

For their own protection we would urge central station managers to equip themselves with standard wattmeter, dynamometer and voltmeter, with which it is a simple matter to determine whether they are getting what they pay for or not.

The tests are quite simple and any central station can equip for making them at very small expense, amounting to but little outside of the cost of the necessary instruments, which are almost a necessity for any central station in checking up switchboard instruments, recording meters, &c.

Central station practice has not yet settled down to uniform methods of installation, but the trend now seems to be in the direction of larger transformers with secondary networks, preferably on the thin wire system; the general introduction of meter basis of charge making it possible to safely connect double the rated transformer capacity in lamps to the secondary network—whereas with the older systems providing a separate transformer for each connection it was necessary to provide transformer capacity equal to the lamps connected.

With separate trasformers of small sizes necessary for individual supply, the aggregate core losses become a serious drain upon the central station. We have frequently seen banks of small transformers serving a single customer or group of customers, this condition being brought about by the gradual growth of demand for light exceeding the capacity of the original transformer installed, a further growth exceeding the capacity of the second, and so on. In such cases the substitution of a single large transformer of modern design displacing the small ones would save its price in less than a year, if credited at the usual selling price, with the amount of current saved. Don't put a modern transformer of good regulation into a group of antiquated transformers of poor regulation; if you do you will lose your new transformer, which is likely to be unjustly condemned for trying to improve the regulation of its bad associates. Placed in such company the new transformer tries to maintain the good regulation for which it was designed, while the lazy, old shirks with which it is connected, steeped in the vice of bad regulation, throw their entire load onto the new comer, which good naturedly carries it all till it can no longer stand the strain and literally roasts out and breaks down under the load.

In most of the smaller stations and in many of the larger ones, money can be saved by remodelling the system of distribution, and at the same time improving the service by laying out a net work of secondary mains, starting first in the business portion of the town with the installation of a few large transformers, reserving the small transformers which these replace—if they are modern and worth keeping—for extensions in the more remote sections where for the time the secondary network is impractical. It may occur in some cases the secondary network will be practical in several different sections, and these separate sections will, in most cases, gradually grow together, allowing taps to be made for new customers at intermediate points. In most cases, where prices are based on meter rates, such an arrangement can be installed at no greater first cost than the individual transformer system, the saving in cost of transformers on account of their larger size and less total capacity required paying for the copper mains. Such an arrangement always results in more satisfactory service to the consumers, at the same time greatly reducing the leakage current necessary to magnetize the transformers or supply the waste in core losses.

A few figures may serve to impress the idea more firmly in your minds. Let us take the case of a station having an average load equivalent to 1000 lights, most of which average four hours burning per night, and, making due allowance for belting, dynamo, line, transformer and secondary wiring losses, we will allow that 10 lights are obtained per 1 h. p. at full load. In the first case we will suppose an individual transformer system is installed, using 10-10 light, 10-20 light, 10-30 light, 5-40 light, and 4-50 light transformers; even with modern transformers these would have an aggregate core loss of about 1200 watts.

If we substitute for this arrangement 6-150 light transformers, connected with secondary mains, retaining the 10 small transformers for isolated customers so scattered as to make it impractical to connect them to the secondary mains, our core losses will be reduced to 692 watts, or a saving of 448 watts for every hour the plant is run, which, for twenty-four hours a day, would amount to 3920 k. w. hours per year, which at 10c. per kilowatt hour would be $392.00, or 6% on more than $6500.00, a sufficient amount to more than pay for the change if no consideration is made of the transformers left on hand, which would be superseded by the new arrangement.

In the case just mentioned we have assumed the original arrangement to be modern transformers. Had we assumed them to be old types the saving would have been three or four times that shown, and would have allowed us to make a good or a better showing had we only charged 3c. per kilowatt hour, which would be less than the cost of production in a station of 1000 lights capacity.

Some of our friends may argue that these losses cost them nothing, as they are running on water power, but we would like to remind them that the capacity in their generators, water wheels, or whatever prime movers they use, represent capital invested, which add to the fixed charges their pro rata of interest and depreciation for which it makes no return; whereas, if the capacity used in overcoming these losses could be rented at the usual rates, a material difference in the capacity to pay dividends would be shown.

METERS AND METER RATES.

By A. A. Dion, Ottawa.

There are few things of more importance to owners of electric light plants, or having a more potent influence for the financial success or failure of electric supply undertakings generally, than meters and meter rates; and all those interested in the satisfactory solution of the problem "how to increase profits from electric supply" should give the subject of this paper thorough and serious consideration.

In these days of close competition in lighting, in common with all other industries, where we feel the need of constant study and investigation in order to find, if possible, means of reducing the cost of production, should we not devote ourselves with equal energy and perseverance to the task of increasing the earning power of our plants?

Upon this question, meter rates have a direct and important bearing.

METERS.

It seems hardly necessary at this time to make a plea for the use of electric meters. Experience has established, beyond question, the fact that the use of meters increases the earning power of a plant. A change from flat to meter rates invariably lowers the peak of the station load curve to such an extent, that the lamp installation may be doubled before the peak regains its previous value; the average earnings per lamp installed will be such as to show an increase in the total revenue, unless indeed the flat rates previously charged were so high as to confine the use of the lights to long-hour consumers.

The use of meters also places the owner of a plant in a position to compete successfully with gas and other illuminants for all classes of consumers, thereby facilitating the extension of his business. This cannot be done under a flat rate system, except by making all sorts of special rates, to meet special cases; a proceeding which is certain to produce dissatisfaction among consumers and often works injustice to the supplier.

No attempt will be made to give in this paper a history of the electric meter; not even to enumerate the many forms that have been produced in the process of evolution, to which we owe the modern recording meter. Too much valuable time would be taken up and no very useful purpose would be served by the recital, as far as this Association is concerned.

Those who feel any interest in the subject may be referred to a paper read by Mr. George W. Walker, before the American Institute of Electrical Engineers, May 21st, 1891. Later meters have been described and illustrated from time to time in the electrical press.

It is necessary to the full success and popularity of the meter system of charging for current, that the meters should be direct reading, in other words that the record of consumption should appear in plain figures on dials available to the consumer, as he has long been accustomed to in gas meters.

The Canadian Electric Light Inspection Act prohibits the use of any but direct reading meters, therefore the choice of meters lies between the different forms of these meters, generally known as "motor meters."

These meters are essentially electro-motors operated by the current to be measured and whose rotating member actuates a train of registering wheels and dials.

They may be divided into two general classes, namely:—

First. Those operating on the inductive principle, wherein an armature consisting of a ring, disk or cylinder of metal, generally iron, is carried around by a rotating magnetic field. This field results from the current to be measured passing through a coil or coils of wire, and the current induced in a closed secondary coil, of low resistance, set at angle with the first; and, second, those embodying the well known principle of the direct-current motor; a wire wound armature rotating within a magnetic field.

Meters of the first class are suitable for alternating currents only, and must be calibrated for the frequency at which they will be operated. They have no commutator nor brushes. Those of the second class may be used for either direct or alternating currents of any frequency. They have a commutator and brushes. That is their weak point, as dirt and moisture will affect the commutator, and the meter will in time run too slow unless it is cleaned occasionally, which is a troublesome proceeding, now that meters are sealed by the Government. They require delicate and careful handling.

Meters of either class may be "current meters" recording in ampere-hours, or "energy meters" which register in watt-hours.

In meters of the first class, which are generally current meters, the torque is approximately proportional to the square of the current, and the speed is proportional to the torque. Such are the "Schallenberger," "Duncan" etc.

In meters of the second class, generally energy meters, such as the "Thomson," the torque is directly proportional to the power applied and the speed is proportional to the torque.

All meter armatures left free to revolve, run so fast at high loads as to seriously impair the accuracy and durability of the meter, and means had to be provided to restrain their speed. This was done in two ways. Small vanes or air fans were attached to the end of arms rigidly fixed to the aramature shaft. These fans lie at right angles to the direction of rotation, and the retardation is due to the resistance of the air against them, which is approximately proportional to the square of the speed, so that this device may only be used in those meters where the torque is proportional to the square of the quantity to be measured. The other way was to attach to the armature shaft a copper disk revolving between the poles of permanent magnets. These exert a drag on the eddy currents generated in the disk by its rotation in the magnetic field. This magnetic drag is proportional to the speed, and is employed in meters where the torque is proportional to the quantity to be measured.

The majority of meters will not start with less than three per cent. of their full loads, and tend to run slow at light and high loads. This is a serious drawback, but there appears to be no effective remedy for it at the present time.

In choosing a meter the first point to be settled is whether to use a "current" meter or "energy" meter. At first sight it would seem that the energy meter would best suit our purpose, as it records the actual expenditure of energy, but where energy is supplied at a constant voltage, the record of the current meter in volt amperes is proportional to the energy. With alternating currents, and especially with inductive loads, the record will be slightly in excess of the energy, but will be porportional to the machine capacity employed, which is a perfectly reasonable charge against the consumer, since it is the maximum load in volt-amperes that determines the size of the plant and the fixed station expenses. The current meter has the advantage of simplicity, ease of adjustment and less cost. It lends itself admirably to the lamp hour-rate of one cent, as its record shows the lamp hours. Rates may be varied to suit all conditions by a system of discounts from the one cent rate.

The desirable characteristics of a meter are: Initial accuracy, constancy, simplicity of mechanism and indicating dials, durability, ability to exclude dirt, insects, etc., and to withstand tampering. Examination and test will determine how far these characteristics are possessed by a meter, except those of constancy and durability, which can only be established by a test of time in regular practice. Both however, depend on good design and workmanship, especially in the jewel bearings which should be of the best quality, accurately ground and thoroughly polished.

The writer has for some years used the "Schallenberger" current meter which has met all the conditions of actual service in quite a satisfactory manner with only ordinary care. He had some experience with a certain type of meter in which so much heat was developed at normal full load as to roast the varnish on the outside of the wire coils. It is needless to say that such a meter should, under no circumstances, be used.

METER DEPARTMENT.

The importance of a well organized meter department and properly equipped meter room, wherein testing, adjusting and repairing of meters may be intelligently carried on, cannot be too strongly urged. This department should be given in charge to one man who may be carefully instructed in his duties and educated to perform his work in an efficient and systematic manner.

When meters are received from the factory they should be examined, tested and adjusted if required before they are sent for government inspection.

Records of these and all meter tests, of meters certified by the government, installed or taken out, and of meters repaired, should be kept in the meter room in a day book for that purpose where entries may be made from day to day, designating such meter by the serial number, size and make. There should also be a ledger into which, day-book entries should be posted. A page to be headed, for each meter in use, by the serial number, size and make. In this way each page will contain a complete history of one particular meter and this will be found very useful for reference.

No meter should be installed, removed or tested without orders from some one in authority. It is a mistake to allow any employee in the office to order meters changed and tested.

METER ROOM.

This room should not be accessible to any employees except those of the meter department.

There should be in a well lighted corner of this room a work bench with such tools and appliances as will be required in repairing and adjusting meters.

A substantial wooden rack should be erected against a solid wall, quite free from vibrations, where the meters may be hung up in rows, by means of hooks or catches, fashioned to hold them firmly in a level position. Flexible wires ready to be inserted in the binding posts of the meters and short-circuiting plug devices, allowing the cutting out of any meter without opening the circuit, should also be provided. The meters should be connected in series and the circuit, which must be of large wire, should pass through a main switch and cut-out, a rheostat to adjust the voltage, a good dead-beat wall ampere meter and a master meter used as a standard in making tests. There should be also, connected across the circuit, a reliable voltmeter, dead-beat if possible, and a bank of incandescent lamps of various candle-powers, say 16, 10 and 5, to adjust the load.

The "master meter" or "standard" should be tested once a month.

The following directions for testing will be found useful. If the master meter is a "current" meter, proceed as follows:

1. Adjust the current to full load of meter.
2. Count the revolutions of the armature by means of the tell-tale index at the top of the shaft or otherwise, for a number of seconds, depending on a constant furnished by the makers for each size of meter. (This constant represents the time taken by the armature for one revolution when a current of one ampere is passing).
3. The revolutions should be counted for a number of seconds equal to several times the constants, in order to secure accuracy, and the revolutions counted during that time, multiplied by the constant of the meter and divided by the number of seconds, should equal the amperes passing through the meter during the test. If the amount is greater, the meter is running fast, if less, the meter is too slow.

4. Repeat the test at half load and quarter load.

The current should be calculated from the indications of a Siemens dynamometer. If none is available, the wall ampere meter, which should be frequently calibrated, may be used instead.

For an "energy meter" proceed as above, adjusting the voltage carefully to normal as well as the current and use a wattmeter instead of the ampere meter. A stop watch is better for this test. If no stop watch is available, two men should make the test, one counting the revolutions, the other holding an ordinary watch. The case should be on the meter during this test to avoid the disturbing influence of air currents, the rotation of the armature being observed through a small window in the top of the case. The voltage should be quite steady.

There may be a separate master meter for every kind and size of meter if desired, but that is hardly necessary.

Meters can be adjusted by altering the angle between the primary and secondary coils in inductive meters, or by shifting the position of the retarding permanent magnets where these are used.

When it is desired to test a number of meters, examine them and see that the armatures are turning freely and the shafts resting properly in the jewel bearings; hang them upon the testing rack, connect them in series, and put the cases on, then

1. Close the circuit, adjust the voltage and turn on one 5 candle-power lamp and see if meters start. (Meters of ten amperes should start on this lamp, those of twenty amperes on one lamp of ten candle power, those of forty amperes on two similar lamps, and those of eighty amperes on two lamps of sixteen candle-power. Meters that fail to start as above should be tagged for repairs.)
2. All the meters on test being of the same size, adjust current to full load and watch the pointers on the last right hand dials; run the meters, including master meter, cutting them in and out of circuit until all the pointers are exactly over a number in the last right hand dial.
3. Open the circuit and take readings of all the meters.
4. Close the circuit, adjust current to half load and allow the meters to run several hours, after which readings may be taken and the "consumption" compared with that recorded by the master meter.

   A meter testing over three per cent. slow or fast should be given a second test to confirm the first.

The advantage of a long run in series with a standard meter is, that it makes it easy to detect and measure very small percentages of error.

When a meter is brought in for any reason it should be tested before it is taken out. When it becomes necessary to test a meter after it has been installed, it is better to bring it to the meter room, putting another one in its place, as no proper test can be made on the consumer's premises. Several methods have been suggested for domiciliary testing, but none are quite satisfactory, besides it pleases a customer better to change his meter when he has lost faith in it.

INSTALLING.

Meters should be of as small a capacity as may be used without inviting their total destruction. It is better to take chances of an occasional burn-out, than to install meters that will run during seventy-five per cent. of their working hours on less than half load and thirty-three per cent. of the time on one-quarter load or less. Under these circumstances meters, as we know them, cannot be expected to do the supply company justice.

It is impossible to entirely eliminate friction in meters, and they stand on the order of their going as it were. They are also slow on light loads. The most effective remedy is to use small meters It is true that they are also slow on high loads, but the high loads seldom come and never stay long.

The importance of using small meters may be fully realized by reference to an experiment reported by Mr. Lyman C. Reed, where a load varying from one to ten incandescent lamps was passed through two meters in series, one of 7½ amperes capacity, the other of 100 amperes. The small meter registered thirty per cent. more than the large one.

Mr. Duncan suggests the following rule for his meter:

For 3 to	7 lights	install a	5	light	meter.
8 "	14 "	"	10	"	"
16 "	20 "	"	15	"	"
25 "	35 "	"	25	"	"
40 "	65 "	"	50	"	"
70 "	100 "	"	75	"	"

No hard and fast rule can be laid down; much depends on the class of consumers to be served. In private residences, for instance, a ten light meter would do up to twenty lights, a twenty light meter up to thirty-five lights, and a forty light meter up to seventy-five lights in the majority of cases.

It has been suggested to put two meters in parallel on large installations, one large and one small meter with a mercury switch actuated by the current and intended to automatically cut out the large meter whenever the load fell below a predetermined amount. The suggestion is worthy of consideration.

Great care must be exercised in carrying meters through the streets. A light express wagon with a box partly filled with straw, wood fibre or other packing, in which the meters may be placed on their backs, is a good thing to move them in. They may be safely carried by hand, also on a bicycle, but in the latter case the rider must be careful to avoid sudden jars.

Whenever a meter is taken out for installation the reading should be taken and left on record in the meter room, in case the reading or "start" is not taken at the consumer's premises.

Meters should not be installed on shaky partitions or those containing doors liable to slam, or on walls subject to vibrations. They should be in a dry place, easy of access and open to daylight or otherwise lighted, and, if possible, they should be protected from extremes of temperature. Meters should not be placed on or too near the floor, nor too high. You cannot expect your meter reader to stand on his head or to carry a step-ladder. In such cases he will attempt to get the reading at a distance and probably get it down wrong.

A little missionary work among electric wiremen and contractors will lead, in time, to the practice of arranging a place for the meters in accordance with the above recommendations.

Before connecting the meter it is well to try lamps here and there about the place, leaving meter loop open, to make sure that there are no branches taken off outside of the meter.

Meters should be levelled and rigidly fastened to the wall. After installing the meter, one or more lamps should be turned on to ascertain that the meter starts readily. For this purpose meter cases should have a window through which the movements of armature or shaft can be seen.

No openings should be left between the cover and the back of the meters where insects may go in. They seem to find comfortable quarters there, and spiders weave their webs around the moving parts, retarding and sometimes stopping the meter. This is more likely to happen where houses are vacated during the summer holidays. The writer has used a stick of pine wood about four inches long, one-quarter inch wide and one eighth inch thick between the cover and back casing of Schallenberger meters, at the top, with good success. It has been suggested to squirt soft putty with a syringe, so as to practically seal the cover to the back, but this is seldom necessary. It is a commendable thing, however, as it excludes dust as well as insects.

The connecting wires should be pulled through the binding posts until no bare copper is accessible from outside the meter case. The cover over the binding posts should be sealed with a lead seal bearing the mark of the meter department. It should be the duty of employees installing meters to see that there are no bare places or cut-outs on the mains between the meter and the service switch and main cut out, and to see that the latter is supplied with copper tipped fuses of the right size properly put in.

READING.

Meters should be read monthly if practicable, as "short accounts make good friends," but the large amount of clerical work involved in this practice often makes it preferable to have only quarterly readings. However, this makes very heavy bills in winter, which is objectionable. A good plan is to divide the six summer months, May to October, inclusively, in two periods of three months each, and the six winter months in three periods of two months each. The shorter winter periods will make the difference in the bills less pronounced and facilitate the collection of accounts. This compromise is confidently recommended as one that works well and gives satisfaction to consumers.

The dates of the readings should appear on the bills, as they will show the number of days covered by the amount and frequently explain apparent overcharges.

Reading meters correctly is not as easy as it looks. Men should be trained in the work and not changed unnecessarily. An unreliable meter reader is dear at any price. Errors in reading are mostly due to the fact that each dial is read by itself. Experience teaches that when a pointer is near a number, it is necessary to consult the next lower dial to determine whether the first pointer is short of or past the number. That is because the pointers are sometimes blunt, improperly set, or have a little side play. A plan which has been very successful in preventing errors, is to furnish the reader with books printed with fac-similes of the dials of a meter. The reader does not read in the ordinary sense, he merely copies in his book the position of each pointer, which is represented by a pencil stroke. The reading is done in the office.

A great saving of time may be made by using numbers to designate customers. Thus the meter reader would enter a reading taken at "A. G. Richardson, 319 Waverley street west" as "958, Richardson." The number is the page of Mr. Richardson's account in the ledger, and the addition of the surname makes identification of the reading more certain.

The clerk entering the readings in the meter ledger should make each day a list of all readings which appear quite wrong from his knowledge of customers and their previous record in the ledger. This list would then be sent to the meter department with instructions to re-read the meters. Many errors will be corrected in this way before the bills are sent out, and meters that stop will be detected.

Consumers sometimes complain that their bills are too high, and some have been known to express the opinion that the meters ran too fast, but the writer once encountered a consumer who said his meter was too slow; that was in Ottawa.

When complaints are made, it is a good practice to get an extract from the complainant's account showing the total net cost of the light for a year. This will often be a pleasant surprise to him, as he has likely figured it out in his mind by taking his highest bill and multiplying it by the number of readings in the year, forgetting the summer bills.

The period complained of should be compared with the corresponding period of the preceding year, if possible, and the preceding period should be investigated to see if meter was not under-read. In any case, offer to re-read the meter. If the first reading is confirmed and the bill really seems wrong, it is better to change and test the meter.

When a customer makes general statements as to the small quantity of light he has used, you should get him down to details. Figure out with him the probable use of each lamp or group of lamps separately. Hold him down to facts. When you come to

add it up he will be surprised, and the meter will generally be found to be not such a liar after all.

STATION METERS.

The practice of metering the output of the central station, which is becoming quite popular, is a move in the right direction. The data obtained through the use of station meters is not otherwise available. It is sure to lead to economies in the station, and will be of material assistance in making and re-adjusting rates.

METER RATES.

In inaugurating meter rates, it has been customary to copy the practice of the gas companies, sanctioned by long usage, of a single rate, with or without discounts off large bills. The conditions under which electric light generating plants operate are, however, very different from those of a gas plant. The gas plant is fully utilized, and works at the point of highest efficiency for as many hours as may be desired, storing the product that is not immediately required. For an electric light plant the contrary is the case.

Forced to run our plant from sixteen to twenty hours per day at a small percentage of its total capacity, which must be such as to meet the large demand which will be made upon it for a few hours every day, we find that the great bulk of our expenses are incurred, not in running the plant, but in getting ready to run.

The charges assumed for each consumer connected to our lines, in order to be ready to supply him, are fixed, whether the lights are to be used ten minutes or ten hours per day. The cost of supplying current after the first ten minutes is only from one-third to one-sixth of the fixed charges previously incurred.

It is easy to understand, therefore, that a consumer using his lights only a short time every day, which is likely to be during the period of highest load at the central station, may not be a source of profit and may sometimes be a source of loss.

Does it not seem reasonable that this consumer should pay such a meter rate that his yearly payments shall cover the fixed expenses made on his account according to the number of units held in reserve for him and subject to his call?

This rate being applied to all consumers for, say, the first hour of the use of their lamps, would fully protect the supply company from loss on account of fixed expenses, so that any additional current would only need to be charged with the variable expenses of running, and could be sold at such a low rate as would encourage the further use of current during the hours of light loads at the central station.

Such a method of charging for current naturally tends to lower the peak of the station load curve somewhat, but specially to build up, if not the lowest, at least the intermediate portions of it, and thereby to increase the earning power of the plant.

The above considerations have led managers of electrical supply enterprises to devise various methods of charging for current in harmony with the principle of differential treatment of consumers, according to their value to the supply company as a source of profit.

Mr. Arthur Wright, electrical engineer of the municipality of Brighton, England, who has devised a system of meter charges known as the "Maximum Demand System," wishing to show the injustice and loss involved in the old single rate plan, cites two cases, his worst and his best customers.

The first employed for his maximum requirements 177 h.p. of the generating and distributing plant, capitalized at $36,966, costing, for interest, sinking fund and depreciation only, $2,582. He used in one year the equivalent of all his lights, burning 61 hours, and paid, on the single rate plan, $823.

The other employed 1.9 h.p. of the plant, capitalized at $394 and costing $27.70 annually. He used in one year the equivalent of all his lights, burning 2,004 hours, and paid $288.

Thus the large consumer who paid $823, and who would under the single rate plan be entitled to the larger discount, was actually a source of loss to the supplier to the extent of $1,759; while the small consumer who paid $288 netted the supplier a profit of $260 on the capital charges, and the variable expenses were also much less in his case, as he received only 3,807 h.p. hours, while the large consumer used 10,797 h.p. hours.

These are extreme cases; yet if similar statistics were compiled from the records of electric supply companies in this country, many cases would no doubt be brought to light which would show the injustice to supply companies and long hour users of the single rate system of charging, in a manner almost as glaring as in the example just given.

The greatest difficulty in the way of these improved methods probably lies in the fact that customers, especially the short hour consumer, will not look at these things through our own glasses. He is not concerned about the unfavorable conditions under which our own plants are operating, and seriously objects to pay a larger average rate than his neighbor, no matter how conditions may differ. It is sometimes argued by advocates of differential rates that the supply company should leave these consumers alone and seek for business rather among the smaller but longer users; but it is well known to those who have had to fight opposition that it is advantageous to have the patronage of the large business houses and to light the more prominent buildings, mostly short hour consumers, on account of the advertising value of such installations.

Among the many systems proposed, the following are the most worthy of notice:

1. The Wright maximum demand system.
2. Differential meter rates based on the installation.
3. Two rate meters.
4. Fixed price per light to cover fixed charges wholly or in part and low meter rate.

The Wright system aims to charge the higher rate for the first hour's use of the maximum current used at any time during a given period without regard to the size of the installation.

The maximum current is indicated by the "demand indicator," an instrument invented by Mr. Wright, which is installed in series with the main current wherever a recording meter is used. It consists of a "U" shaped glass tube with a bulb at each end, partly filled with colored sulphuric acid and hermetically sealed. A strip of platinoid is wound around one of the bulbs. The current is made to pass through the platinoid strip, which becomes heated and the air within the bulb expands, driving the liquid up the other leg of the "U" shaped tube until it reaches the other bulb, when it overflows down into a branch tube, which is graduated to indicate, by the height of the liquid within it, the maximum current that has passed through the instrument; the expansion of the air being proportional to the heat developed, therefore to the square of the current. When this instrument has been read it may be re-set by tilting it until the liquid runs out of the branch tube. The cost of this indicator is about ten dollars.

In Brighton, England, where the system has been working very successfully for about three years, the rates charged were in 1898 fourteen cents per kilowatt hour for the first hour's daily use of the maximum current recorded on the Wright meter, and three cents per kilowatt hour for any additional consumption. It will be seen what inducements are offered to long hour users. This was found to be equivalent to an average rate of 6.64 cents per kilowatt hour.

The system may be modified to suit local conditions; thus the higher rate may be applied to less or more than one hour's daily use, and again this quantity may vary according to season. The Chicago Edison Co., who use this system, charge for fifteen hours' use of the maximum demand per month in summer at one cent per lamp hour. For the six winter months the rate is applied to forty-five hours' use per month. Additional consumption is charged at half rates. The Edison Electric Illuminating Co., of Boston, make the hours' use to be charged at the one cent rate vary from month to month. The hours are ten in July to fifty in January.

Whatever may be said against the Wright system, there is no doubt that the use of it or some other differential system would enable us to better compete with gas in the case of such long hour consumers as drug stores, hotels, etc.

The demand indicator will not record demands lasting less than fifteen minutes, but a consumer may require an unusual number of lights on some special occasions, and he is unwilling to have his bill increased by an amount out of reasonable proportion to the privilege required. In cases like that, experience has shown that it is necessary to read the indicator before and re-set it after this unusual demand, and to take no account in the bill of this special maximum. This proceeding in a large city would involve considerable expense and trouble and complicate the system somewhat.

When the indicator has been read and re-set there is no record left of the indication except in the company's books which may lead to disputes with consumers difficult to adjust.

A device intended to combine with an ordinary recording meter the advantages of a demand indicator has been put on the market by Mr. Edward Halsey, of Chicago. It can be applied, it is said, to any meter using magnetic drag as a retarding device. The armature shaft is divided horizontally in two parts and they are connected by a ratchet coupling. The upper part carrying the armature has a pointer rigidly attached to it, and the lower part carries the copper retarding disk, which is graduated. The pointer normally stands at zero over the copper disk. The operation is a follows: As the demand increases the speed of the shaft and the magnetic drag also increase. The lower part of the shaft lags behind the upper part by an angle dependent on the torque or the energy passing through the meter, the ratchet coupling maintains the angle between the parts when the current is afterwards reduced, and the position of the pointer over the copper disk may be read as the maximum demand.

Another method of charging, probably ante-dating the Wright system, and aiming at the same results, consists in charging the higher rate on the first hour, more or less, of daily use of all the lights installed.

While this method removes the necessity of the extra meter or indicator it is open to several objections.

It puts a large burden of charge on the short hour consumer and discourages the installation of lights with the probable effect, that the consumer will install electric lights where the daily use of them will warrant this proceeding and employ gas or some other illuminant for the lights that are seldom used. While this may cause no direct loss to the supply company, it is not conducive to the popularity of electric lighting, which would be considered somewhat of a luxury.

It is not as equitable as the Wright system, inasmuch as our fixed charges are not governed by the total installation as much as by the maximum demand, and two consumers with equal installations may show great differences as to their maximum demand on the station. The system for instance does not discriminate between a consumer using say thirty lights (all his lights) one hour and another using ten out of his thirty lights three hours.

Residence lighting which should be specially encouraged, would be discouraged by this system.

The expense and difficulty of ascertaining the number and candle-power of the lights installed would be considerable. Constant checking would be required, involving frequent domiciliary visits by the inspector, and there would always be uncertainty as to data so obtained.

Still another variation of differential rates is found in the use of the two-rate meter of the General Electric Company. This

meter has two sets of registering dials and armature is connected by a clutch by one or the other, at any predetermined time, by the agency of a clock contained in the meter and automatically wound up by the current.

Thus, the left hand dials for instance will record the consumption taking place during the few hours of station peak, which will be charged at the higher rate, and the left hand dials will record the consumption at all other times, which will be entitled to the lower rate.

This system does not discriminate against the short hour consumer to the same extent as the two systems previously described; he is only charged the higher rate for such use as coincides with the station peak, and only to the actual amount of such use from day to day, and in its tendency to straighten out the station's load curve it is the equal of the other systems.

Those short hour consumers whose local peak never coincides with the station peak would, under this system, get a lower rate, which is no doubt quite just.

The two rate meter does not need re-setting and preserves its record so that errors in reading may be rectified at any time.

The meter costs about $25 more than the ordinary recording meter.

There is a class of consumers that are undesirable under any system of meter charges. I refer to the very small consumers who use less than $10 per year, and while an electric supply company may not refuse any business without inviting public criticism, there should he a minimum charge of $10 and upwards per year for each customer.

In some cases the minimum is made large enough to cover the fixed charges, or a large percentage of them, and a very small meter rate is charged in addition. This is a sort of compromise between the flat and meter rates, and should be a popular plan for certain classes of customers.

It offers to the consumer the advantage of knowing practically the amount he will have to pay and equalizes the winter and summer charges, and the small meter rate will prevent useless burning of lights. It is not a system suitable for general application, but it may well serve, however, as a transition from the flat to the meter rate, and might be tried with advantage by those charging flat rates exclusively.

There is so much to be said for and against the various systems which have been proposed, that supply companies still charging a single meter rate find themselves face to face with a very difficult problem. With so many things to choose from, it is perhaps a case of "how happy could I be with either," or they hesitate to make a change which may cause them temporary loss of revenue. The single rate certainly has the advantage of simplicity and is thoroughly understood by consumers, but so long as it will be used, so long will it be necessary to make special contracts of all kinds, and the flat rate will continue to flourish with more or less vigor.

In conclusion it should be said that meters and meter rates is too broad a subject to be treated satisfactorily within the limits of a convention paper. If the two topics had been separated and each formed the title of a separate paper, the results would no doubt be of greater value to the members of this Association.

LONG BURNING ENCLOSED ARC LAMPS.

By Wm. A. Turbayne, Hamilton.

The major factor of expense coupled with the operation and maintenance of arc lamps arose from the necessity of frequently renewing the carbons, which, in the sizes adopted in practice, had a life of some seven or eight hours only. As the all-night lighting of streets demanded that lamps should be capable of giving an uninterrupted service of from twelve to fourteen hours burning, various means were devised whereby this period could be covered by a single trimming of carbons. Innumerable types of lamps were designed with this end in view but there remained to be adopted as standards the double carbon lamp, which burned two successive pairs of eight hour carbons and, as an alternative, the single carbon lamp fitted with circular or elliptical carbons of sufficient cross section to insure a life of fourteen or sixteen hours.

Aside from the matter of trimming, however, the carbons themselves were a source of heavy expense, and early endeavors were made to perfect some means whereby their life could be materially prolonged without at the same time incurring a sacrifice of the light. It was clearly understood that the rapid wasting away of the carbons was caused mainly by their combustion or oxidation in the open air, and it naturally occurred that if the arc could be maintained in a transparent chamber, from which the oxygen of the air had been excluded, that this combustion would cease and that then the only waste would he that due to vaporization.

Experiments along these lines were conducted and the results would undoubtedly have been encouraging had it not been chiefly for the fact that, in burning in an enclosing chamber, such a deposit soon accumulated on its inner surface as to seriously obscure the light and thus render the arrangement unpractical and, therefore, as these attempts to increase carbon life proved futile, fourteen or sixteen hours per trim was, until very recently, accepted as the burning period of an arc lamp.

The great demand within the last eight or ten years for interior arc lamps operating from incandescent lighting circuits was met by a marked improvement in carbon manufacture, until finally a practically pure article was obtainable, the advent of which made possible the maintenance of an arc in an enclosing chamber and allowed of the development of the long burning lamp as we have it to-day in which a carbon in size equal to the eight-hour carbons of open arc lamps has a life of one hundred and fifty hours or more.

This longevity is effected by the method which failed some years ago on account of the lack of sufficiently pure carbons; in short combustion is prevented by a removal of the oxygen from the space immediately surrounding the arc, the oxygen not being literally removed by exhaustion, but rather by a process of chemical conversion wrought by the action of the arc itself. The carbons are surrounded by a glass globe of small area, closed at the base and only sufficiently open at the top to allow of a free passage of the upper carbon. On the formation of an arc the air contained within this globe is heated and rarified, the surplus finding an outlet through the upper opening; the remaining oxygen is reduced by combustion with the carbon to carbon monoxide (C.O.), a gas which is somewhat lighter than air, having a specific gravity of .969, and although combustible will not support combustion. This, together with the nitrogen which is liberated, completely fills the chamber and prevents further combustion of the carbon, although a small amount of air diffuses through the upper opening —a condition essential to satisfactory operation, as otherwise the vaporized carbon would condense and appear as a sooty deposit on the inner surface of the globe, while as it is, the oxygen of the entering air unites with this vapor and forms a gas. A slight deposit of silicon accumulates, which, however, does not seriously absorb the light, and which may be readily wiped off during trimming.

As a result of the absence of oxygen in the enclosing globe the ends of the carbons do not become tapered by burning but remain flat and blunt, and the device could not be adapted successfully to the existing lamps in use, which maintain a potential difference of some 45 volts across the arc, as, in the small separation of one-eighth inch or under consequent upon this voltage, too much of the light would be intercepted by the lower carbon. It was therefore imperative, in order to obtain proper distribution, that the carbons be more widely separated, and it was found that in the enclosure an arc of approximately ⅜ inch in length could be maintained with an E.M.F. of some 75 or 80 volts. Meanwhile it is necessary that the current employed should not exceed 6½ or 7 amperes, for obvious reasons associated with the cleanly burning of these lamps for long periods, and in order further that the watts expended may correspond with those expended in an open arc lamp of like rating. While a so-called 2000 candle power lamp of the latter type operates with a current of 10 amperes at an E.M.F. of 45 volts or 450 watts, an enclosed lamp of like rating may operate at 6.5 amperes and 70 volts, or at 5.5 amperes and 82 volts, the higher E.M.F. and reduced current resulting within certain limits in better operation.

Enclosed arc lamps in general require special features in the feed mechanism, although the governing principles are identical with those obtaining in the open lamps. As it is necessary to separate the carbons from ⅜ or ½ inch it is usual to have the magnets act directly on the upper carbon without the intervention of levers, and this calls for a long range magnet of considerable power. In order also to obtain good regulation it is desirable that the moving armature be of considerable weight, as compared with the weight of the carbon to be lifted, as therefore decrease in weight of the carbon is not accompanied by an appreciable lengthening of the arc.

Enclosed lamps will operate efficiently in series on direct constant current circuits employing currents not greater than 6.8 amperes, and on alternating current circuits in conjunction with constant current transformers. In these instances the lamps must be of the differential or shunt feed type, and must be further provided with short-circuiting cut-outs such as are found in the well known open series lamps. A similar type of lamp is required for operating in series multiple on street railway and power circuits, but in place of the short-circuiting cut-out a device for shunting a resistance, equalling that of the arc, across the terminals is used in order that if one or more lamps cut-out or proved defective the current traversing the remainder would not rise. It is necessary also that a steadying resistance be placed in series with each group of such lamps.

Enclosed lamps for operating in parallel on direct and alternating current incandescent lighting circuits require a very simple feed mechanism and contain neither shunt magnets nor cut-outs. For adjusting the carbon a single magnet only is required connected in series with the arc. Such a magnet responds to variations in the current strength and tends to maintain this factor constant irrespective of variation in terminal voltage, but as this latter is a constant factor the magnet therefore in keeping the current factor constant must likewise keep the arc resistance and length constant also.

A retarding device such as a dash pot is required in these lamps to allow of a gradual separation of the carbons, alternating lamps especially demanding a comparatively slow separation.

As direct current lamps usually operate on circuits of 110 volts it is necessary to interpose a resistance in order to reduce this to about 80 volts as required across the arc, and, while this resistance wastes energy, yet it is necessary to the successful operation of the lamps. The alternating lamps are more fortunate in this respect inasmuch as a reactance coil may be placed in series with the arc which will reduce the voltage to that required across the arc with but little waste of energy. They may also be operated direct from transformers delivering the necessary arc voltage, or from economy coils, or auto-converters.

A type of lamp which represents simplicity in the extreme is that in which the separation and feeding of the carbon is effected by the expansion and contraction of a strip of metal interposed in the path of the current. Such a device, while not satisfactory when used in conjunction with open arc lamps, appears to he excellently adapted to parallel burning enclosed lamps, in which the arc is protected from draughts of air, and which feeds only at long intervals. For this particular purpose, as compared with electro-magnetic feeds, the advantages all appear to be with the thermal feed. Such lamps strike their arc quietly and slowly

without being necessarily retarded in their action by dash-pots, their feed is positive, and slight frictions in the moving parts introduce no noticeable error; they may be operated at will on direct currents, or on alternating currents of either of the standard frequencies. On alternating currents the power factor of a load of these lamps would be high as compared with a load of lamps having large magnet coils and cores, and in the matter of maintenance there appears to be nothing about such a lamp to suggest repairs, although the replacing of an occasional regulating strip would be much cheaper than the renewing of magnets.

Aside from the economies of enclosed lamps resulting from the increased life of the carbons they possess other advantages peculiar to themselves. As a result of the absolute enclosure they burn quietly, being free from hissing or flaming even though not accurately adjusted, and, as it is impossible for sparks to make their exit, all possible fire risk is eliminated, a feature which meets with the unanimous endorsation of the Boards of Fire Underwriters generally.

By virtue of the long arc which is maintained more perfect distribution of the light over large areas is obtained than is possible with open arc lamps. Direct current lamps of the latter type exert their greatest illuminating effect at an angle of about 45 degrees from the vertical so that a very intense light is noticeable within a radius slightly exceeding the height of the lamps from the ground while beyond this the illumination rapidly falls away. Enclosed lamps on the other hand spread their rays more horizontally, their angle of maximum intensity being about 75 degrees, and as a result the light is more regularly diffused over a large area and does not assume the form of concentric zones of rapidly diminishing intensity.

The economy in maintenance however affords the most striking example of the advantages of enclosed lamps over the open and the gain will be clearly noted by a comparison of the two systems. As an example we may compare the maintenance costs of 450 watt open and enclosed alternating current lamps operating 10 hours per day per year of 365 days, assuming for the former a life of 14 hours per trim of carbons costing $36.00 per 1000, while for the latter a life of 80 hours per trim of carbons costing $30.00 per 1000. In this comparison the matter of interest and depreciation allowance may be dismissed on the assumption that it will be similar in each case and thus there remains to be calculated the cost of carbons and trimming.

As the open lamp requires two new carbons per trim it will in a year therefore, on the above basis of 10-hour runs per day, require some 261 pairs of carbons, costing $18.80; on the other hand the enclosed lamp requires but one new carbon per trim and in a year will consume but 46 carbons, costing $1.38, so that an annual saving of some $17.42 per lamp is effected by the use of the enclosed lamps.

The cost of trimming will depend largely upon local conditions but we may assume that one man at $2 per day can trim one hundred open lamps or one-half as many enclosed lamps, which will make the cost per trim, therefore, 2 cents and 4 cents respectively. On the 10-hour basis the trimming, therefore, will cost approximately $5.62 per open lamp per year, as against $1.84 per enclosed lamp per year, resulting in a further annual saving in favor of the enclosed lamp of $3.78, making the total saving $21.17.

With direct current lamps the saving will be in like ratio, allowances for differences in the life and cost of carbons being necessarily taken into consideration, but whether direct or alternating the advantages of the enclosed lamp are so apparent that before a great period elapses not only will they largely supplant the open arcs, but they will further enter the arena in competition with large incandescent lamps and regenerative gas lamps.

THE PROPER EFFICIENCY OF INCANDESCENT LAMPS FOR CENTRAL STATIONS, INCLUDING A DESCRIPTION OF THE NERNST LAMP.

By E. E. Cary, St. Catharines.

Few questions in the field of electric lighting are of greater importance to central station managers than that of the efficiency of incandescent lamps. This problem of suitable efficiency, many may justly think could be handled more properly by the central station manager than by the manufacturer, but it must be borne in mind that the manufacturer is in close touch with many stations and is thus able to observe the inauguration and development of theories incident to the subject. Few questions seem so thoroughly misunderstood, and yet the fault is not entirely with the central station. In the first place, only the larger companies will invest in the necessary apparatus, and surprisingly few of these will purchase enough apparatus to determine the efficiency of their lamps. The initial outlay, including photometers and instruments will more than pay for itself in the first year. In the absence of the proper outfit, the managers have to depend upon the statements of manufacturers or more often upon those of their representatives, and what is the result? Dissatisfaction. One maker will supply lamps guaranteeing them to be of a stated efficiency, and these lamps will give satisfaction. Should the next order be placed with another company and the same efficiency guaranteed, chances are strongly in favor of the second consignment not giving satisfaction, assuming the specifications call for efficient lamps. Both lots of lamps may consume the same current at the stated voltage and in reality be intrinsically equal, yet one will be thought well of and the other condemned. A situation such as this, upon the face of it, seems incredible, yet such is the daily experience of every lamp manufacturer until, by long and often costly experience he becomes thoroughly acquainted with the actual state of affairs upon the lines of all his customers.

For many years generators, and later transformers, have been rated in light capacity upon the basis of fifty watt lamps. Multiples of fifty are convenient quantities to handle mentally, though, when this unit of capacity was adopted, everyone felt confident of the universal adoption of fifty watt lamps.

It has been unfortunate that 3.1 watt lamps have become such a household term, as their use has often proven very costly to companies before experience made them alter first ideas.

Everyone will probably agree that it is desirable to use the most efficient lamps possible, consistent with fair life where current is supplied upon the meter basis. Two questions immediately arise: what should be considered fair life, and at what efficiency under conditions existing upon the lines can this life be most economically obtained. Hardly two managers will agree upon the first question, and very few have at hand the necessary information to answer the second.

Every lamp maker, however worthy of the name, has on record the results of many tests showing the average life to be expected of lamps of different efficiencies when operated at normal or at voltages other than normal. Below in table 1, will be found the efficiency and average life of lamps at various voltages. Though these results are in one sense approximate only, yet they are the average results of many tests.

Before discussing the table, it is well to state that the efficiency of an incandescent lamp is generally given in watts per candle. A lamp radiating sixteen candles when operating at fifty volts, and one ampere of current, consumes fifty watts, and has therefore an efficiency of 3.1 watt per candle. When lamps are tested for efficiency, one grievous error is generally made. The voltage is taken carefully as labelled on the lamp instead of being taken at the point of the lines where the lamp will be used. For example any lamp, whatever its normal efficiency may be, can, and often is operated at a much higher efficiency. For instance a four watt lamp is often burned at three watts, and a three and a half watt often burns at two and a half watts. This is simply to show that when a manager talks of using more efficient lamps, he may be operating at that very time, lamps at a higher efficiency than he contemplates using.

EFFICIENCY AND AVERAGE LIFE OF LAMPS AT VARIOUS VOLTAGES.

Efficiency in Watts per C.P. at Normal Voltage.	Average Life at Constant E.M.F.	98 per cent. of Normal Voltage.		99 per cent. of Normal Voltage.		100 per cent. of Normal Voltage.		101 per cent. of Normal Voltage.		102 per cent. of Normal Voltage.		103 per cent. of Normal Voltage.		104 per cent. of Normal Voltage.		105 per cent. of Normal Voltage		106 per cent. of Normal Voltage.	
		Actual Watts per C.P.	Actual Life in Hours	Actual Watts per C.P.	Actual Life in Hours	Actual Watts per C.P.	Actual Life in Hours.	Actual Watts per C.P.	Actual Life in Hours.	Actual Watts per C.P.	Actual Life in Hours.	Actual Watts per C.P.	Actual Life in Hours.	Actual Watts per C.P.	Actual Life in Hours	Actual Watts per C.P.	Actual Life in Hours.	Actual Watts per C.P.	Actual Life in Hours.
4.5	2400	4.85	3500	4.68	2600	4.5	2400	4.34	2060	4.21	1830	4.06	1600	3.92	1400	3.8	1240	3.7	1120
4.	1500	4.31	2000	4.16	1750	4.	1500	3.86	1330	3.74	1160	3.62	1020	3.48	880	3.38	800	3.28	710
3.5	900	3.77	1200	3.64	1040	3.5	900	3.38	800	3.27	700	3.16	620	3.05	550	2.96	490	2.87	440
3.1	580	3.34	760	3.22	660	3.1	580	2.99	500	2.9	460	2.8	400	2.7	360	2.62	320	2.54	280
2.5	260	2.69	350	2.6	310	2.5	260	2.41	230	2.34	210	2.26	190	2.18	170	2.11	150	2.05	140

If a station is using 3.5 watt lamps and had absolutely steady voltage, an average life of 900 hours could be expected. If the voltage however, is two per cent. high, this life is reduced to 700 hours, and the efficiency increased to 3.27 watts. If however, the voltage is four per cent. high the life is reduced to 550 hours, and the efficiency increased to 3.05 watts. Though the candle power is increased, the total watts consumed is not proportional and the station suffers doubly in consequence. Four per cent increase in voltage of a sixteen candle power lamp increases the light emitted about 20 per cent.

This table will probably impress on central station managers how vitally important it is to know the voltage at which their lamps are operating upon different portions of their lines. Unless the regulation throughout the system is unusually uniform, it is most profitable to have the entire system divided into sections or zones, and order lamps of different efficiencies adapted to give the life settled upon as desirable. If the fluctuations are comparatively the same in the different zones, then the same efficiency can be used, only the lamps should vary in voltage, the voltage to be used to be the same in each zone. The manager immediately states that this causes too much confusion, etc., yet it is good business, and is a no more confusing problem than many others in manufacturing. When a method like this is carried out, very black lamps would disappear, average life be greatly increased and customers would be much better pleased. Take a customer upon your lines where the voltage is four to six per cent high, not to speak of twenty per cent. as is often found, and when you replace burned out lamps what is the result; the new lamps may emit from twenty to thirty-two candles and the old lamps eight to ten. Naturally the customer complains that the old lamps are worthless, and to keep peace, you replace these also and he starts with practically all new lamps, the same trouble to be gone through with later on. In the meantime you are apt to write the manufacturer that his lamps are blackening badly and return these specimens as fair samples. Troubles arising from causes similar to this have forced manufacturers oftentimes, who cannot or will not investigate the trouble, to send out their lamps uniformly of a higher voltage than is marked on the labels. This is in one sense self protection which the manufacturer is forced to do if he wishes to retain the trade which is often at such a distance that he cannot afford to investigate personally,

Most lamps imported from the States to-day, are much higher in voltage than indicated on the label. Yet the central, station if it has not due regard for the light emitted, will be pleased with the lamps as they may last almost indefinitely. The most welcome information a manufacturer can receive is to the effect, that a central station does not wish a lamp to last forever so to speak. Consider for a moment how small the expense of the renewal item is under normal conditions. Assuming only six hundred hours average life at the low average meter rate 6/10 cents per lamp hour the income is 3.60. Good lamps can be purchased for 20c. each or less than 6% of the income.

When lights are furnished upon the flat rate basis, and the renewals are paid for by the consumer, highly efficient lamps are not desirable.

When central stations will determine intelligently the proper efficiencies of lamps which they should use, and take means to hold manufacturers to their specifications, then their lamp renewal account will considerably decrease and the legitimate lamp maker prosper proportionally.

Below is given another table of current in amperes taken by lamps at various voltages and candle powers at different efficiencies, which may be found useful for reference.

Current in Amperes Taken by Lamps at Various Voltages and Candle Powers.

3.1 Watts per Candle.

Candle Power.	50 Volts.	55 Volts.	80 Volts.	95 Volts.	100 Volts.	105 Volts.	110 Volts.	120 Volts.	220 Volts.
8	.50	.45	.31	.26	.25	.24	.23	.21	.11
16	1.0	.90	.62	.52	.50	.47	.45	.41	.23
25	1.6	1.4	.97	.82	.78	.74	.70	.65	.35
32	2.0	1.8	1.3	1.1	.99	.94	.90	.83	.45
50	3.1	2.8	2.0	1.7	1.6	1.5	1.4	1.3	.71

3.5 Watts per Candle.

Candle Power.	50 Volts.	55 Volts.	80 Volts.	95 Volts.	100 Volts.	105 Volts.	110 Volts.	120 Volts.	220 Volts.
8	.56	.51	.35	.30	.28	.27	.26	.23	.13
16	1.1	1.0	.70	.59	.56	.54	.51	.47	.26
25	1.8	1.6	1.1	.92	.88	.84	.80	.73	.35
32	2.3	2.0	1.4	1.2	1.4	1.1	1.0	.94	.51
50	3.5	3.2	2.2	1.9	1.8	1.7	1.6	1.5	.80

4 Watts per Candle.

Candle Power.	50 Volts.	55 Volts.	80 Volts.	95 Volts.	100 Volts.	105 Volts.	110 Volts.	120 Volts.	220 Volts.
8	.64	.58	.40	.34	.32	.31	.29	.27	.15
16	1.3	1.2	.80	.68	.64	.61	.58	.54	.29
25	2.0	1.8	1.3	1.1	1.0	.95	.91	.84	.45
32	2.6	2.3	1.6	1.4	1.3	1.3	1.2	1.1	.58
50	4.0	3.7	2.5	2.1	2.0	1.9	1.8	1.7	.91

Before describing the Nernst lamp I will say in reference to 220 volt lamps that great progress has been made in their manufacture during the past year or two, but that little further is necessary in making them more efficient before they will be on a par with 110 volt lamps. In addition to this, plants must be installed calling for a range of 220 to 240 volts before the cost of the lamps can be brought to its proper level by the manufacturer.

During the past year vague rumors have occasionally been wafted across the water of the discovery of a new light, although details of the discovery were entirely lacking until Mr. Swinburne delivered his now famous lecture before the Society of Arts in London, February 8th. I will quote from this lecture a few descriptive remarks and then give some criticisms of the lamp from other sources. Mr. Swineburne in speaking of Nernst's discovery says: "Nernst's like most great inventions, is exceedingly simple as soon as it is understood. The efficiency of an incandescent body, as far as radiation goes, depends simply on temperature of the filament only, providing there is no loss by convection. The carbon will not stand a sufficiently high temperature. Nernst therefore chose a material that would stand higher temperature than carbon, and his material has the incidental advantage, that its specific resistance is so high, that strong rods can be used for high pressure instead of thin filaments. Nernst takes highly refractory oxides as his material. It does not seem promising, because such oxides are notoriously good insulators. But such insulators are electrolytes when hot; Nernst therefore, heats the rod to make them conduct, and then heats them electrically, preserving a temperature which is within the limits that the material can bear without softening. * * * The material is worked up into little white rods. Each rod is mounted on two platinum wires, a little paste made of refractory oxides being applied to the joints. The little rod with its two wires, is then mounted in holder which fits ordinary electric light fittings. As the rods fall in resistance as the temperature increases, after the manner of electriolytes, an increase of current produces a decrease of resistance. This tends to give some instability in running in parallel on supply circuits. This instability is corrected, as in an arc lamp which has analogous properties due to a different cause by a series resistance. The Nernst rod has therefore a resistance in series. This is made up of exceedingly fine wire, and for ordinary circuits amounts to 10 or 12 per cent. of the whole resistanceof thelamp. The consumption, including the resistance is 1.5 watts per candle for large lamps, and 1.6 for small lights of low pressures. In small or low pressure lamps the loss of heat at the ends is larger in proportion.

Such a lamp as I have described will not light up of itself, for the rod is an insulator when cold. The simplest way to start it is to warm it with a match, or better with a small spirit lamp. Such a lamp as this is not only very cheap as regards first cost, but economical in running. The life of rods, running at an efficiency of two-thirds of a candle per watt, including the resistance, is already more than 500 hours in good specimens. If the Nernst lamp advances as much in the first years of its existence as the carbon lamp did between 1880 and 1882, it will soon be made so well that the rods will last a lifetime. When the rod is worn out, a new rod with its little mounts is all that is replaced. The whole lamp is not thrown away at all. The small lamps and the lamps of medium size are in practice started by a heating resistance. This is arranged close to the rod, and in shunt to it. As soon as the rod is hot enough to conduct, its current works a tiny cut-out in the resistance circuit. In large lamps the heating system is a little more elaborate, as the resistance arrangement is arranged as a sort of hood which covers the rod. As soon as the rod conducts, not only is the resistance circuit broken, but the electro-magnet lifts the little hood clear off the rod. In all these forms, the rod and its mounting are replaceable without interfering with the rest of the lamp."

The above extracts give a very clear idea of the Nernst lamp, as first described to the public by those interested in promoting a large company for its exploitation. There are however serious practical difficulties involved in the practical operation of these lamps at the present time. Assuming however for the sake of argument that the Nernst lamps can be operated successfuly in practice, the relative cost of this operation compared to arc and incandescent lamps is what chiefly interests the central station manager.

The English Electrical Review recently published an article by Mr. John I. Hall upon "The Nernst Lamp vs. The Arc and Incandescence Lamps." I quote for your information a part of this article, giving comparisons in cost between the Nernst and Arc lamps. These are the only figures that have been recently published. After speaking of various methods of lighting, Mr. Hall writes: "But at present the position of the various illuminants may be summed up as follows:—

1. The Welsbach system is an advance over the ordinary method of lighting by gas.

2. The enclosed arc lamp is an advance over the open arc.

3. The Nernst system is an advance in incandescent lighting.

The electric lamps are placed in the order they will occupy in regard to cost of maintenance, for as the Nernst lamp supersedes the enclosed carbon lamp, so does the arc lamp supersede the Nernst lamp.

Mr. J. Swineburne, in the prospectus of the Nernst Electric Light, Limited, states that: "It will, I believe, oust the arc lamp in nearly all cases." On examination it will be found that it will not oust one arc lamp at present in use, as the following particulars will show:

The Nernst lamp is said to give 1 C.P. for an expenditure of 1.5 watts. The arc lamp (2,000 N.C.P.) absorbs 500 watts and actually gives 1,200 C.P. The Nernst lamp to give 1,200 C.P., will require an expenditure of 1,800 watts, or 3.6 times more energy than the arc lamp. 1,800 watts = 1·2 kilowatts per hour, which will cost to the consumer 3·6d. per kilowatt per hour.

The arc lamp absorbs 0·5 kilowatt per hour, and this at 3d. per unit equals 1·5d. These figures are for public lighting; for private consumers the cost is, of course, increased. Allow a liberal amount for carbons, trimming and cleaning, &c., say, 0·5d. per hour, then there is 1·5 + 0·5 = 2d. per hour as the cost of the arc lamp against 3·6d. as the cost of the Nernst lamp.

The figures given above are for the open arc lamp, but for the enclosed arc lamp the cost would be about 1·6d. against 3·6d. for the Nernst lamp. In other words, instead of our corporations running their street arc lamps for, say, £18 per annum per lamp, they will, by adopting the Nernst lamp, run them at £64, or spend £46 more per lamp.

It will therefore be considerable time before the municipal electrical engineer is found who will be ready and willing to come forward and suggest the ousting of the arc by the Nernst lamp.

The Nernst Electric Light, Limited, prospectus further states that "there is no difficulty in running in parallel on 1,000-volt circuits without transformers." It will be of some interest to the electric light engineers to find the 1,000-volt circuits without transformers amongst the electric lighting stations. However, the merits of the 1,000-volt lamps can be considered as against the arc lamps.

Suppose the advantages of the Nernst lamps are considered running in parallel on 1,000-volt mains. Is there any economy in conductors to be secured under these circumstances? Take a section of, say, 20 arc lamps, with transformers, running in parallel and controlled from a substation. The current required will be

$$\frac{20 \times 500 \text{ watts}}{2{,}000 \text{ volts}} = 5 \text{ amperes primary current.}$$

For 20 Nernst lamps the current will be

$$\frac{20 \times 1{,}800}{1{,}000} = 36 \text{ amperes primary current.}$$

Thus it will be seen that, taking the most favourable conditions set down by the prospectus of the company for the Nernst lamp to compete with the arc lamp, a cable of seven (7) times the sectional area will be required, in addition to the transformer, for them to run on existing installations where the E.M.F. is 2,000 volts.

The cost of the lamp cases and posts now remains to be considered. It may be taken that the lamp-posts will cost about the same in both cases. The arc lamp complete, with hood and globe, costs, say, £6, and the Nernst lamp £1. This appears to be a fair price, allowing for promotion anticipations without actual figures as to cost.

The first cost, and maintenance for 12 months, may now be considered, voltage 2,000 lamps in parallel:—

Arc lamp and transformer, say	£12	0	0
Say cost of cables	3	0	0
Maintenance for 12 months	18	0	0
Total cost	£33	0	0
Nernst lamp and part cost of transformer situate in sub-chamber (voltage 2,000 to 1,000)	£3	0	0
Cost of cables	21	0	0
Maintenance for 12 months	64	0	0
Total cost	£88	0	0

There are other considerations of cost, such as conduits, depreciation and interest on capital outlay, which the electrical engineer will observe are not in favor of the Nernst lamp, and so they are, in kindness, omitted.

To summarise the foregoing particulars, it is pretty plainly to be seen that the rosy and light-hearted view taken by the Nernst Company as to ousting the arc lamp will need some slight modification, especially on the score of first cost and economy. Unfortunately for the new comer there are such things as cables to be taken into account and maintenance.

So, then, the manufacturers of open and enclosed arc lamps, are not yet to put up the shutters, stop the machinery, and discharge the workmen; but it is not so pleasant an outlook to the carbon lamp manufacturer unless he commences to make the Nernst type of lamp (under license, of course) or improve the carbon lamp, as will appear later on.

But there are other considerations to be taken into account where the advent of the Nernst lamp will be most beneficial, and where it will be appreciated, as we shall have for street lighting two illuminants to choose from, and where one is not applicable the other will be most serviceable.

It may be considered that for lighting large areas such as squares, public markets, &c., and main streets and roads, the arc lamp will not be superseded, but for the lighting of narrow streets, public halls, &c., the Nernst lamp will be a most valuable acquisition, on account of the increased economy in running.

In all the circumstances it must be considered that the lamp is automatic in its action, as the match-assisted lamp is out of question in 1899, excepting, of course to the promoters. The engineer and manager of one of the most successful gas works in the country said to me, when discussing the merits of the Nernst lamp: "Why, you will be going back to the old barbarous times of gas lighting if you use a match to light your incandescent lamp, and all the advantages of the enclosed filament lamp will be dispensed with."

Before closing you will probably be interested in one or two experiments upon the Nernst lamp.

THE PROTECTION OF LOW TENSION WIRING AGAINST DANGEROUS HIGH POTENTIAL CURRENTS.

By W. J. Plews, Montreal

Allpersons in connection with electrical supply companies, especially in lighting service by alternating currents, have long recognized the necessity of some reliable apparatus to prevent low tension service wires inside buildings from becoming a possible source of danger to human life, or as regards fire, in event of contact with high tension conductors. That this condition often exists, and that the danger therefrom can hardly be overestimated, is a well known fact to all Electricians who have had experience with alternating current systems.

Some years ago, the principal element of danger was the liability of transformers to break down between the primary and secondary coils. Of late, however, conditions have changed considerably, the more recent types of transformers being a vast improvement on the older ones. While the contingency as regards transformers is not now so great as in former years, the change in the system of secondary distribution, involving as it does the use of large secondary units and a net-work of wires covering a great area, has given rise to another and if anything a more important element of danger, namely, the increased liability of accidental contact between high and low tension conductors. This change in secondary distribution has been rendered necessary from an economical standpoint, and as it is not at all likely that anyone will revert to the old system, the proper course seems to be the protection of individual equipments.

The contingencies previously mentioned have proven a frequent cause of fire, and in some instances have resulted in fatal accidents. Recognizing these dangers, various earthing devices have been contrived to cope with the difficulty. It seems, however, that the idea has been to afford protection from the breaking down of transformers only, by means of blowing the primary fuses, the inventors apparently not having taken into consideration the contingency of accidental contact between local and foreign conductors, whereby a large volume of current at a high potential may flow over the secondary apparatus and destroy both it and the protective device, in which event the protective device itself would probably become a source of fire.

Several of the cases which have come under the observation of the writer, wherein conditions as mentioned have existed, have been of such a nature that any earthing device, depending upon the blowing of a fuse for its action, would have been a positive fire hazard. One instance in particular was a cross between a fallen secondary and a trolley wire. In this case had there been any device of the type mentioned, a volume of current would have flowed through the apparatus sufficient either to destroy it or blow the secondary fuses; this latter occurring, it is reasonable to assume that the high tension current would have maintained an arc across the terminals of the cutout, (one such as generally used for low tension wiring) and produced disastrous results.

As far as the writer's knowledge extends, the principle, common to all safety devices of this nature, heretofore developed, has been to disconnect the local system from the source of danger by means of blowing fuses. This principle appears to be radically defective, the blowing of a fuse under such conditions being an uncertain element, attended at times with undesirable results.

In any apparatus designed to protect local low tension systems from currents of higher potential than they are constructed for, or expected to carry, it would seem more rational to employ a device that will automatically and instantaneously disconnect the high tension current from the low tension system to be protected, without depending upon the uncertain action of fuses. It is also believed that a device of this nature should be one in which the amount of current necessary for its successful operation is a known quantity, and that this quantity be as small as possible, so as to avoid dangerous arcing.

Considering the matter from this point of view, the writer believes that an apparatus can be constructed which will embody the desirable characteristics, and it is to this possibility that your attention is respectfully invited.

One form of such an apparatus, which is on exhibition here, is similar in action to a double pole knife switch, and is so constructed as to automatically open the circuit instantaneously, whenever the low tension wiring is brought into connection with conductors charged with dangerous high potential currents, either through a break-down in a transformer, or a cross between secondary and primary, or other high tension conductors.

The great advantage claimed for this apparatus, is that no matter how large the volume of current may be, only a small fraction is required to operate the device, and this only for an infinitesimal period of time, the device in opening, disconnecting both the safety apparatus and the interior wiring from the outside source of danger. Another advantage is in the fact that the device provides special facilities for rapidly testing the local system for grounds, without the use of other apparatus.

During the past few years many fires have originated from high potential currents accidentally traversing secondary systems and breaking down the insulating joints which intersected the junction between fixtures and gas pipes. From the manner in which first-class electric light wiring is installed at the present day, it would seem impossible for a current at a potential of say two thousand volts, to cause a rupture between secondary wiring and ground, and the writer's experience leads him to the conclusion

that if the so called insulating joints properly performed their function, fires from this cause would be extremely rare.

If on the other hand low potential systems are so arranged that there is no chance for high potential currents to rupture to ground, there remains the danger of some person receiving a fatal shock while handling the apparatus.

In view of these facts, it would seem advisable to equip all low potential systems, which are exposed to the contingencies herein mentioned, with an automatic device that in time of need will operate effectively.

CENTRAL STATION ACCOUNTING FROM A BUSINESS STANDPOINT.

By P. H. Hart, Montreal.

Mr. President and Gentlemen, —Before proceeding to a description of the system of accounting which I will offer for your consideration, it seems appropriate to state a few of the reasons why a standard system of accounting for central stations ought to be adopted.

The reasons why are many and substantial.

The individual owner of a small plant is as much interested in having accurate knowledge of the condition and details of his business and a determinate method of obtaining such condition and details, as the manager or directors of a large joint stock company.

A proper system of accounting should show to the directors, manager, proprietor or other interested party (and for the sake of brevity I will hereafter refer to such parties as manager) besides the profits or losses of the business, the cost of producing what is sold, and should demonstrate this cost in such manner as to enable him to learn what the product costs in its various details, and particularly the costs separately of generation and distribution.

These being determined and ascertained in the ordinary progress of business and due account being had of interest on investment and depreciation of plant, the manager can compare costs and determine where excesses arise, whether in the generation or distribution, and the reasons therefor. It should also show promptly and definitely the condition of affairs of a business at any and for given periods, which is a decided requisite and absolutely essential to sound business administration. It should be such as to enable the manager to determine the advisability of soliciting or catering for any particular line of business that may be offered or obtainable and indicate the most profitable, and be a guide, preventing indiscriminate investment in pole line construction, apparatus, etc., and show at all times the value of the investment for such purposes as insurance, arbitration, assessment, etc., etc. With such information created, compiled and formulated in the regular progress of the business, the manager will be enabled to consider intelligently operating costs and the advantages or disadvantages of further investment.

I may here call your attention to some interesting information which appears in the 14th annual report of the Board of Gas and Electric Light Commissioners of Massachusetts, Public Document No. 35. This shows that out of 58 electric light companies operating in that state, with a total investment of over $17,000,000, five of the companies appear not to have earned expenses, and 32 have not earned sufficient to warrant the declaration of any dividend ; thus very near 10% of the electric light companies operating in that state do not earn expenses, and $\frac{37}{58}$, 63%, are not earning sufficient to make a return to the investors on their capital. Many of them, no doubt, may have believed they were doing well until a rigid system of accounting had been applied.

These commissioners are doing much to standardize the system of accounting in use by electric lighting companies in that state, and this statistical information is the direct result of a uniform method adopted by these commissioners in adjusting the statements submitted by the various companies.

Mr. H. A. Foster, who investigated in detail 160 electric lighting stations of the United States, for the United States census, in a work based on the information gathered by him in the taking of this census and recently published, entitled "Central Station Bookkeeping," regrets the lack of system in accounting shown by the various electric lighting stations which came under his notice, and lays particular stress on the necessity of accurate accounting in central station work, for obvious reasons.

In addition to other reasons for and the advantages of a standard system of central station accounting, I might say that in the event of the question of municipal ownership or purchase arising the manager should have definite knowledge as to the cost of investment, cost of operating, etc., to compare with assumed cost of municipal operation.

I will now present to you a system of accounting at present in use, having the objects above outlined in view, the results of which have been highly satisfactory, and in connection with it a system of records which form necessarily a part of a thorough accounting system. In the presentation I will indicate some of the various books and forms in use.

Central station accounting from a business standpoint should proceed from and be based upon an order system, guiding, directing and allotting in advance, the distribution of expenditure for investment, operation or maintenance and of revenue to the several distributions or sub-divisions of those general items that may be deemed desirable. And here I may say that such subdivisions should be as numerous as the several details of a business and when arranged for and determined upon beforehand, becomes, in practice, very easy of allottment or apportionment.

A written order should be issued covering each and every transaction, indicating the character of the transaction and the accounting to which the expenditure incurred therefor is to be charged, or the revenue derived therefrom is to be credited. This to be determined and declared in the order before the expenditure is made or the revenue derived.

Such system necessarily means that for every debiting entry to an account, something must be credited and all entries and accounts must result in a perfect balance, so that double entry bookkeeping is absolutely necessary to the practical working and comprehension of this system.

The system referred to herein, and partially illustrated by various forms or blanks, can be readily put into operation by any company and practically at any time desired. Under the system described as at present carried out, the accounting is eventually grouped into what may be designated as general accounts, which are kept in a general ledger. All the other accounts, subordinate to these general accounts, and forming what may be designated as the working accounts, and which lead up to and are finally grouped into general accounts, are kept in other or subsidiary ledgers. This subdivision of books or ledgers is done in this instance simply as a matter of convenience, because the volume of business is large and necessarily requires to be attended to by a number of persons ; but the principle involved would permit carrying all the accounts in one set of books if the volume of business were so small as to make that desirable.

The general accounts consist of the assets and liabilities, and may be sub-divided in accordance with the wishes of the manager —as, for instance, the asset account of merchandise might, if desired, be sub-divided into fuel, line supplies, station supplies or wiring supplies, etc., such accounts representing materials on hand for use as required, either for any addition to construction or for operation or maintenance of plant.

The asset account of plant and construction account may be subdivided into station construction, lines and poles, real estate, buildings, etc.

The feature of the general accounts is practically no different from that of any other double entry bookkeeping system of accounts. The method in which this system may vary from ordinary methods of bookkeeping is principally in what may be known as the working accounts, and it is here that the formulation of the accounting and the determination to which account work under any given order shall be entered, arises. In the forms shown will be noticed the titles of sub-divisions of the working accounts representing expenditures. They show construction accounts, operating accounts and maintenance accounts subdivided into the various details, upon which it has seemed desirable to accumulate and record information.

All orders issued involving expenditure recite thereon the account and sub-account to which the expenditures made thereunder are to be charged, and all returns of labor, material or expense incurred upon such order are reported, quoting the number of such order (all such orders being numbered serially.)

Expenditures which are continuous during the entire year, such as, for instance, labor and material and expense for the operation and maintenance of the station, or labor and material required for the trimming and inspection of arc lamps and lines, may be dealt with by orders covering the entire year or parts thereof, say monthly, the latter being preferable. Monthly orders for work of this character are preferable to yearly orders, because as soon as the expenditure authorized under an order has been completed, such order is turned in to the office or bookkeeper, marked as completed, and thereafter no expenditure can be made chargeable to that order.

It will be observed that the purpose sought to be accomplished by these orders is the localizing and sub-dividing of the expenditures to the particular parts of the work being done upon which the management deems it necessary to have accumulated and specific information. In the forms submitted, there are sub-accounts representing different parts of the operation within the station, sub-dividing it into boiler room, engine room and the electrical generating room ; similarly it sub-divides the work outside, the inspection, trimming of lamps, lines, the additions to the plant, whether within the station or outside, and also seeks to separate the different classes of service.

It is, of course, important that the returns made upon these orders be in accordance with the instructions contained in the order. Thus, for instance, an order authorizing the inspection of lines should not have charged to it or reported against it the coal consumed under the boilers, and experience has demonstrated that employees very soon become accustomed to reporting and sub-dividing their work in accordance with the designations of the orders under which they are acting, so that in practice the allotment of expenditures for labor, material or other expense becomes automatic, with the result that the bookkeeper can indicate at any time the amount expended for any sub-account. By using subsidiary ledgers for this purpose, arranged similar to blank or Form No. 1, which, as will be perceived, is a re-arrangement of the items upon the Form No. 2, and total up month by month or day by day as they may be recorded therein, the costs of each sub-account. Periodically, say monthly, the totals of these accounts are transferred either to asset accounts or to the debit of the revenue accounts, according to their character.

The bookkeeper in debiting the returns on these orders to their various accounts, must make corresponding credit to certain other accounts ; labor to credit of labor account ; material or merchandise to credit of material or merchandise accounts, sub-divided as it may be ; expense to expense account, and the totals of the credit of these accounts must, of course, balance with the totals debited to the accounts represented by the orders. When the labor is paid, the amount paid is debited to the labor account, thereby checking the accuracy of the pay rolls, which may be made up either from the returns upon the orders or by independent returns, but all labor represented by either the independent re-

turns, time sheets or otherwise as may be used, must balance with the accounts credited as above to labor account, and debited to the accounts represented by the various orders.

In the detail working under these orders through a number of employees, means of obtaining material and making returns under and to these orders become necessary, and where a large number of employees are engaged, these necessarily require the adoption of other forms or blanks, as, for instance, the requirement of material necessitates for the execution of any order that an application be made that the employee needing that material to the store room or storekeeper, where such material is kept on hand, or through whom it will be purchased if need be. In the system described, this becomes what is known as a requisition, blank No. 6, and in filling out such requisition the employee requiring the material quotes thereon the No. of the order on which he intends using it. Similarly in making returns of labor or time, the time ticket or labor return blank specifies the order No. authorizing such labor. Blanks or forms authorizing the return to store-room of any surplus material that may have been taken out on an order, also recite thereon the order No. to which it is to be credited or upon which it is returned. In all these returns or reports, besides quoting the No. of the order, the accounting of such order is also recited, the object being to prevent the error of charging a wrong account through a mistake or transposition of the order Nos.

Revenue accounts may also and in the system herein referred to are sub-divided or classified into various accounts of service from which the revenue is obtained, as, for instance, alternating current incandescent lighting, alternating current motor service, direct current motor service, arc lighting, etc., and this subdivision may be made as minute as the management desires.

Dealing with a large number of customers, it is important that means be adopted whereby none shall escape from the grasp of the bookkeeper or collector. Therefore no customer should be connected with the service lines except under an order, as above described, authorizing such connection and supply of the service called for. Upon completion of such order, it is returned to the bookkeeper, with notation thereon that connection has been made and supply of service begun. Meanwhile, that is, as soon as the order to make connection has been issued, the contract signed by the customer upon which the order has been issued, is transmitted to the bookkeeper, who immediately opens in his ledger an account with such customer. On the return of the completed order, the bookkeeper notes in his ledger at the customer's account, the date of starting, which is also marked upon the contract. The customer's contract is not filed or put away or considered as being in operation, until such notation has been made.

As an additional precaution, when the account is opened in the ledger, a card similar to Form No. 7 is prepared by the bookkeeper, giving the customer's name, address, ledger folio and number of contract (and all contracts are numbered serially), character of service, and generally the main details of the contract and service. This card is filed according to ledger folio, and accumulates the record upon which the debit side of the customer's account in the ledger is created.

In cases where meters require to be read, these cards constitute the guide to the meter readers as to what meters are to be read. In sending out accounts to customers for service, every card must be accounted for by an invoice, and the fact of such invoice rendered noted thereon. In other words, the card is used to make out the invoice against the customer and the invoice is used to enter the account in the ledger, and every account in the ledger must be represented by an invoice.

The use of the method of making the entries in the day book and ledger from the invoice instead of making the invoice from the record book, is to hasten the transmission of accounts to customers, in order that they may not have any cause of complaint for delay in the opportunity to pay their accounts.

In practice, the invoices are made out during the month as far as possible, leaving only the final entry to be made when the amount of the invoice has been determined, so that it becomes possible to transmit a large number of accounts within practically one day after the meter readings have been taken.

The cards, in fact, constitute the history of the relations of the customer with the company, and at a glance show the variations in the use of service, for, as will be perceived, they are made to cover the year's transactions. They apply equally well for "flat" rate customers as for meter customers, though they are for recording meter readings. In the case of meter customers, they indicate the variations of use and afford a guide to the bookkeeper to inquire into the accuracy of the meter reading reported; any falling off or unusual increase in the use of the service as indicated by a reading immediately attracts the attention of the bookkeeper or billing clerk, thereby causing him to institute an immediate inquiry into its accuracy. In the case of "flat" customers, it declares at once the proper amount of the account to be rendered, by the record of the account previously rendered.

The debits to customers are credited to the several sub-divisions of the revenue accounts, that is, the customer may be using several kinds of service, the amounts for which are debited to his account, but credited each to the revenue account to its individual class of service. This results in determining the revenue obtained during any period from each kind of service, the total of all, of course, representing the entire revenue obtained and offsetting the expenditures made therefor.

Companies having to deal with a large number of customers and various classes of service, and varying discounts, resulting from special or large consumption, will necessarily require for the convenience of the cashier, a secondary or subsidiary cash book in which can be noted the special discounts or allowances made, as well as the cash received for the various classes of revenue. A form of such cash book is indicated in blank No. 8. This cash book, or rather entry book, for the receipt of cash and discounts, applies only to discounts stipulated in the contract. Other allowances, rebates or credits are made only by authority of order issued specially therefor in each case.

Assuming this system of accounting to have been properly and carefully carried out to the end of the fiscal year, we would now have before us the total revenue from the business in its various classes. On the other hand, we would have the total cost of operation and maintenance, general expense and the total expenditure on capital account for the year; taking the total revenue derived and deduct from that the total cost of operation and maintenance, will give the gross profit. From this gross profit is to be deducted the general expense. The general expense account should include only such items as are purely general. By that I mean expense which cannot be charged to any specific working account, and is purely general in its relation to the business, such as interest, office expenses, directors' fees, salaries of officials, legal expenses, travelling expenses, for instance expenses incurred in attending Electrical Association Conventions.

Deducting the general expenses from the gross profit will give the net profits of the business for the year, exclusive however, of depreciation. This question of depreciation is usually determined by the management. It always has been a much discussed question, and authorities find it very difficult to agree on a uniform method of application, the changing value of apparatus being so widely different.

However, one of the definitions of depreciations, given by Mr. E. Hartley Turner as "The re-payment of capital out of the total gross revenue earned during a given period of such proportion of the original capital outlay as has been absorbed or consumed in earning such gross revenue" is very good, could the amount so absorbed be readily determined. A definite plan, however, is to apply to property in which a residue of value under any circumstances must remain, a graduated percentage upon its changing value as representing depreciation. The amount of this depreciation, however, will be governed to a great extent by the amount of the expenditure on maintenance account.

In the presentation of this paper, I have endeavoured to follow out the question of Central Station Accounting from a business standpoint solely. With this in view, it has been confined almost entirely to the question of the method of ascertaining costs of generation and distribution, and recording from whence revenue has been derived and the methods of assuring the obtaining of all the revenue derivable. I have assumed that the important features are the knowledge of costs and the sources from which the revenue can be most profitably obtained.

The question of purchase of material and the recording of these purchases have not been touched upon, this method being practically similar to all lines of business; neither has reference been made to the obtaining or keeping of records pertaining more particularly to the Engineering Department, for the reason that this subject has been exhaustively considered in a paper entitled "Some Central Station Economies," submitted by Mr. P. G. Gossler at the annual convention held in Toronto in 1897.

Whilst, no doubt, the system herein described may appear elaborate and extensive in detail, and perhaps seem to entail expenditure for labor beyond the reach or desire of managers of small stations, I see no reason why the principle involved may not be used in any station at a slight expense. For while perhaps not requiring to employ all the sub-divisions indicated upon the blanks or forms shown, yet many of them can be utilized and put into practice with such modifications as the local conditions demand without imposing upon the manager or employees any labor or expense beyond that which can be afforded, and if I have succeeded in conveying ideas and information that may serve towards the adoption of a general system of Accounting for Central Station practice as suggested by the authorities referred to in the beginning of my paper, I will feel myself amply compensated.

PROPOSED POWER DEVELOPMENT.

The annual meeting of the shareholders of the Canadian Electric Light Co. was held in the city of Quebec on June 27th. The report presented by the directors stated that the $200,000 of capital required in virtue of the prospectus had been subscribed, that the Chaudiere Falls water power would be acquired immediately, and that the directors were in negotiation with the Council of the town of Levis for furnishing light and power. It further stated that the services of Mr. Raoul Girouard, of Cumberland, Maine, had been secured as manager, and that Mr. A. R. Henry, M.E., of Quebec, would probably be appointed electrical engineer. The directors have two plans under consideration for the development of the water power of the Chaudiere Falls, one made by Mr. J. M. McCarthy, C.E., of Montreal, and the other by Messrs. T. Pringle & Son, of Montreal. According to their figures a minimum of 5000 horse power is obtainable. Arrangements are said to have been made with the Chaudiere Valley Railway Co. to construct and operate electric railways in the counties of Levis, Bellechesse, Dorchester and Lotbiniere, obtaining power from the Canadian Electric Light Co. Directors were elected at the meeting as follows: President, John Breakey; Vice-President, Hon. L. P. Pelletier; H. M. Price, Gaspard Lemoyne, James King, R. Audette, R. Wilson-Smith, H. S. Holt and H. T. Machin.

Difficulties having arisen in connection with the carrying out of the contract for the Ragged Rapids transmission scheme at Orillia, Ont., it is probable that the work will again be opened for tender.

SPARKS.

The Robb Engineering Company, Amherst, N.S., are building two 350 horse power engines for the San Paulo Railway, Light & Power Co., Brazil.

Messrs. Eager & Sanderson, of Winchester, Ont., are installing a 500 light dynamo. The entire plant was furnished by the Royal Electric Co., of Montreal.

The warden of St. Vincent de Paul penetentiary, near Montreal, has called the attention of the Dominion Government to the necessity of installing an electric light plant.

Messrs. Grafton & Co., Dundas, Ont., are operating their tailor shops by S.K.C. two-phase motors, current being supplied by the Dundas Electric Co.'s two-phase plant.

Messrs. Steinhoff & Gordon, of Wallaceburg, Ont., will probably establish a heading mill at Tweed, Ont., and in connection therewith put in an electric light plant for lighting the town.

Price Bros., of Amqui Mills, Que., have their entire saw mills, docks and yards lighted by electricity. The plant, which was furnished by the Royal Electric Co., started up a few nights ago.

A new company, to be known as the Lorette Electric Light and Power Co., has been formed at Lorette, Quebec, and will undertake the lighting of that village and of the Indian and Parish churches; the capital stock will be $10,000.

Mr. A. A. Dion,
President Canadian Electrical Assotiation.

A report from Barrie, dated June 20th, stated that the Royal Electric Co. had made application to the council for a franchise for an electric railway between Barrie and Allandale, a distance of one mile, with privilege to extend to other points.

The manufacturing warerooms of Mr. Geo. Bean, of Dundas, Ont., have been changed from the old motive power to electricity, the Dundas Electric Co. furnishing the current, and the Royal Electric Co. a two-phase S.K.C. motor to drive the establishment.

Dr. J. T. Nicholson, late professor of Mechanical Engineering at McGill University, Montreal, was made the recipient of a testimonial from his colleagues in the Faculty of Applied Science, on the occasion of his leaving for Manchester, Eng., where he will in future reside.

The town of Liverpool, N.S., is about to establish an electric light plant, tenders for the supply of which will be received by Mr. D. C. Mulhall, mayor, up to Friday, July 28th. The contract for constructing dam, power house, wheel-pit, conduit and tail race in connection therewith, has been awarded to F. W. Clarke, of Bridgewater, N.S.

Ald. Peck, of New Westminster, has received the appointment of Inspector of Steam Boilers for the province of British Columbia, a position created at the last session of the Legislature.

Mr. E. E. Cary,
1st Vice-President Canadian Electrical Association.

The new 75 k.w. S.K.C. dynamo was put in operation at Grand Valley, Ont., a few days ago, and is now supplying from one phase of the machine, the town of Grand Valley with 500 incandescent house lights and some 50 c.p. street lamps. From the other phase of the same machine, which is wound for a 5000 volt curreut, they are supplying the town of Arthur, 12 miles away, with about 600 incandescent house lights and five enclosed arc lamps, as well as fifteen 32 c.p. incandescent street lamps. This plant is one of the most unique and complete in Canada.

Mr. P. G. Gossler,
2nd Vice-President Canadian Electrical Association.

MR. W. W. GRANT.

We have pleasure in presenting to readers of the ELECTRICAL NEWS the accompanying portrait ot Mr. W. W. Grant, who has recently been appointed by the Westinghouse Electric & Manufacturing Company, of Pittsburg, Pa., to act as their representative in Canada in conjunction with Messrs. Ahearn & Soper, of Ottawa. The following brief particulars of Mr. Grant's career will suffice to show his capability for this position.

Mr. Grant is a native of Ottawa, and a son of Sir James Grant, K.C.M.G., of that city. He is a graduate of the Royal Military College of Kingston, which is recognised as one of the foremost educational institutions in Canada. Owing to his standing at this institution, and the marked perseverance displayed during his college course, he was awarded a commission in the Royal Engineers of England, which is the highest branch of the British military service. After due consideration, however, he declined this offer, recognizing that there were larger possibilities in America.

After having graduated, Mr. Grant was engaged in practical work in Canada for about two years. In 1892 he entered the

MR. W. W. GRANT.

employ of the Westinghouse Electric and Manufacturing Company, of Pittsburg, Pa., starting at the bottom of the ladder in the factory, and thence passing through all departments of the company's extensive works. In 1893 he was appointed one of the erecting engineers on the Hamilton Street Railway during the reconstruction of the road. In 1895 he was transferred from the construction to the business department of the Westinghouse Co., where he became associated with Mr Maurice Coster, who is recognized as being one of the most prominent and successful engineering salesmen connected with the company. In 1896 he removed from Pittsburg to the company's New York office, and in recognition of the value of his services during the two-and-one-half years of his residence in New York, he was chosen to fill the important position which he now occupies in Canada. There is no room to doubt that from the steady advancement which Mr. Grant has made in the past, due to his ability and faithful performance of duty, he will fully meet the requirements of his present position.

Messrs. Taylor & Co., of Dundas, Ont., have placed an S.K.C. two-phase motor in their work shop, and will hereafter operate by electric current furnished by the Dundas Electric Co. Dundas will soon follow the lead of Hamilton, and become, with all its factories, a smokeless city.

SPARKS.

The citizens of Medicine Hat, N.W.T., are considering the question of granting a franchise for electric lighting to a local company.

The Cataract Power Co. is announced to have secured control of the Hamilton Street Railway system. As a result, it is understood that the construction of the contemplated electric roads to Guelph, Galt, Berlin, St. Catharines and other points will be undertaken at an early date.

Messrs. A. C. Miller & Co., of the steamer "Alexandria," have placed their order with the Royal Electric Co. for a complete electric lighting plant for this new steamer. The work of installation is going on now, and on completion it will be one of the best electrically equipped vessels on the lakes.

The first meeting of the shareholders of the Victoria Telephone Co., Limited, was held at Woodville, Ont., recently, at which directors were elected as follows: President, J. G. Eyres, Woodville; vice-president, J. G. Campbell, Orillia; treasurer, C. E. Weeks, Woodville; secretary, Wm. A. Robinson, Cannington. The directors decided to build lines to Beaverton, Orillia, Midland, Barrie, Lindsay, Peterboro, and other places as soon as possible.

Messrs. Geo. Wilson & Co., of St. Catharines, who operate a large planing mill and sash and door factory, where they have plenty of refuse for steam purposes, have found it cheaper and more satisfactory to operate their mill by electricity, and have entered into an agreement with the St. Catharines Electric Light & Power Co. to furnish them with from 50 to 75 h.p. They have also placed their order with the Royal Electric Co. for a 50 k. w. S. K. C. synchronous motor. There are also a number of other firms who contemplate making changes from steam to electricity.

A circular from the International Correspondence School, Scranton, Pa., states that the United Correspondence School and the American School of Correspondence have recently been established, using many of the copyrighted instruction papers of the International Correspondence School. Suit has now been entered by the Colliery Engineer Co., in the United States Circuit Court, to restrain these schools from using their papers, and for infringement of their copyright, and students are warned against having such pamphlets in their possession, in case the Colliery Engineer Co. are successful in establishing their allegations.

The St. Catharines Electric Light & Power Co. have enlarged their water power, and are in a position to furnish power and light throughout the twenty-four hours. They have lately installed a 200 K.W. S.K.C. two-phase generator, from which they are supplying light on their single-phase mains throughout the city during the hours of lighting, and during the day are furnishing two-phase alternating current to the various industries throughout the city. This company had been supplying arc and incandescent lights only, but as there was a considerable field for power, in which one plant, a 500 voltdirect current system, was already engaged, they decided to put in something which they could use for both purposes, hence they have only one investment in using the poly-phase system instead of two using the direct current power system and an alternating current lighting system

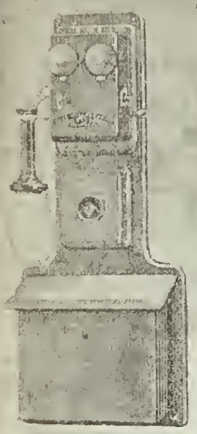
The town of Shelburne, Ont., will probably purchase the electric light plant from the present proprietors.

Mr. James S. Craig has been appointed city electrician for Toronto, as successor to the late Donald Gibson.

The engine for running the electric plant for the Toronto city hall has been ordered from the Robb Engineering Co., Amherst, N.S.

The electric light plant owned by the town of Kamloops, B.C., has been found inadequate, and steps will likely be taken to increase it by two boilers of 150 h.p. each, an engine, pump, heater and dynamo. It is probable that an engineer will be engaged to report on the plant before the council takes any action.

At the annual meeting of the New Brunswick Telephone Co., held at Fredericton, N.B., on June 14th, it was decided to put in a double metallic circuit between St. John and Fredericton, and extend the trunk line from Fredericton to Chatham and along the north shore. A. A. Stockton, Charles Fawcett, Joseph Black, A. G. Blair, F. P. Thompson and W. T. Whitehead were elected directors.



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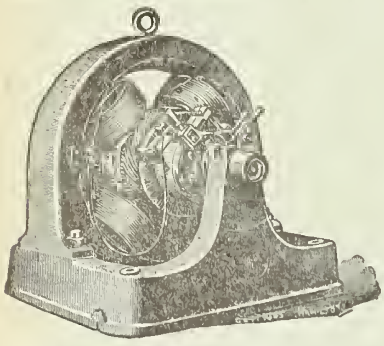

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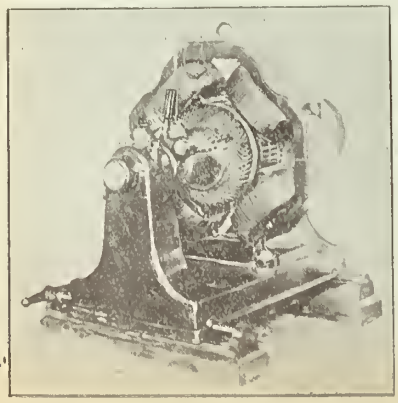

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VOL. IX. AUGUST, 1899 No. 8.

CABLE LAYING FOR CHAMBLY TRANSMISSION LINE.

THE accompanying photographs illustrate a somewhat novel method of laying cable under unusual conditions. As may be known to the readers of the CANADIAN ELECTRICAL NEWS, the Royal Electric Co., of Montreal, for the Chambly Manufacturing Co., have installed the electrical equipment in the power house of the hydraulic development of the Chambly Manufacturing Co. at Richelieu village, on the Richelieu river, 16 miles from Montreal. They have also erected the transmission line between the power house at Richelieu and the city of Montreal.

FIG. 1.—VICTORIA JUBILEE BRIDGE, MONTREAL—VIEW LOOKING EAST.

The hydraulic development will amount to 20,000 h.p., with a head of 28 feet. There have been installed four generators of 2,000 capacity each, so designed and wound to generate 12,000 volts, the latter voltage being the pressure at which the power will be transmitted to Montreal by means of a duplicate pole line, each line consisting of 16 copper wires of No. 00 B. & S. gauge. Before reaching Montreal, however, it is necessary to cross the St. Lawrence river, which is spanned at this point by the recently completed Victoria Jubilee bridge. This bridge, with approaches, is approximately 8,750 feet in length.

The transmission cables for this section of the line are laid in a wooden box placed on the sleepers, on a level with and four feet out from the steel rail. (See Fig. 2.) Each box is designed to contain sixteen cables.

In placing these cables, the somewhat unusual method of laying them by means of a locomotive and flat cars was used (see Fig. 4). Four flat cars were loaded with reels, each reel containing 1,000 feet of cable, and then jacked up into position, ready to pay out. The cable was paid out over a specially designed cast iron sheave 22 inches in diameter, which was carefully shrouded to avoid any injury to the lead sheath. This sheave is shown in Fig. 3, which also shows the cables, two in number, being paid out. The ends of these cables being securely lashed in position in the cable box, the locomotive and cars were then started and kept moving at the rate of about four miles an hour. The cable paid out over the cast iron sheave, ran back to the rear end of the car and over two wooden rollers, suitably placed, then dropped into the cable box on the floor of the bridge.

Two reels of cable (2,000 feet) were laid in five minutes, by actual count, and in eight hours 26,000 feet of cable was placed in position and ready for jointing. The major part of the time was consumed in loading and unloading cable reels and running backwards and forwards for laying cables. A section of the type of joint used is shown in Fig. 5. Great care had

FIG. 2.—TRANSMISSION LINE OVER VICTORIA JUBILEE BRIDGE, SHOWING BOX FOR CABLE.

to be used in making these joints on account of the high voltage of transmission. The cable was made by the Washburn & Moen Mfg. Co., of Worcester, Mass., and consists of a core of 37 tinned copper wires of a cross-section equal to No. 00 B. & S. gauge, insulated with 8-32" of rubber compound. This cable is made to withstand a test of 20,000 volts for one hour, and a breakdown test of 35,000 volts.

The cable is protected by a pure lead sheath 3-32" thick, no alloy of tin and lead being used as is ordinarily done, for the reason that a sheath of pure lead would not be so liable to crystallization from vibration of the bridge structure as would be one composed of tin and lead.

We are indebted to Mr. J. A. Burnett, of the Royal Electric Company, who personally superintended this installation of cable, for our illustrations.

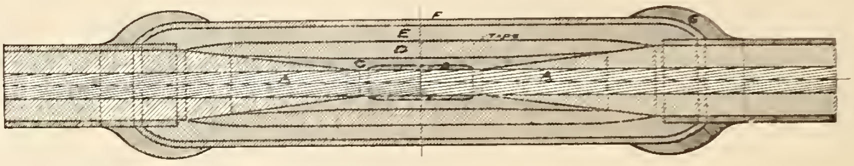

FIG. 5—WASHBURN AND MOEN CABLE JOINT USED.

A—Copper conductor.
B—Tinned copper sleeve connector.
C—Pure jointing rubber.
D—Jacket jointing rubber.
E—Compound poured in.
F—Lead sleeve.
G—Wiped solder joint.

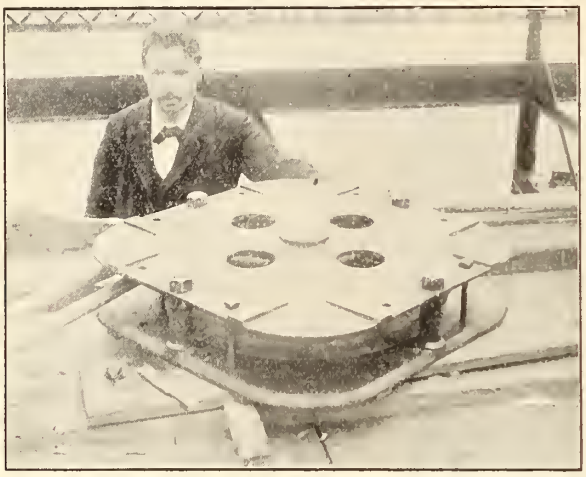

FIG. 3.—SHOWING SHEAVE ON CAR.

ANNUAL MEETING OF OTTAWA ELECTRIC LIGHT COMPANY.

THE annual meeting of the Ottawa Electric Light Company was held last month. There was a large attendance of shareholders.

The annual report of the directors stated that the revenue from all sources for the year ending April 30, 1899, was $161,615. The expenses of operation and maintenance, with interest on the bonds, etc., amounted to $113,268, leaving a net surplus of $48,346.

From this surplus a dividend of 6 per cent., or $44,653 for the year 1898-99, was paid on the capital stock of $765,800, leaving a balance to go to credit of profit and loss of $3,692.

During the year $57,878 was expended on new plant. The total plant is now valued in the company's statement at $1,209,438. The report was adopted, and the board of directors re-elected as follows: T. Ahearn, president; Hon. E. H. Bronson, vice-president; J. W. McRae, managing director; Hon. F. Clemow, Denis Murphy, John Coates and F. P. Bronson.

The number of incandescent lights increased by the largest figure for any year in the company's history, namely, by 14,142. The total number of incandescent lights now in use is 77,255. The arc lights number 621.

It is interesting to note the growth of the number of lights in use, notwithstanding which the gas company has continued to flourish. The following shows the growth in the electric company's business since the start:

	Incandescent Lights.	Arc Lights.	Heaters.	Motors.
1894	42,152	440	11	81
1895	48,797	468	15	81
1896	53,331	497	19	81
1897	57,240	550	30	87
1898	63,113	509	32	96
1899	77,255	621	23	103

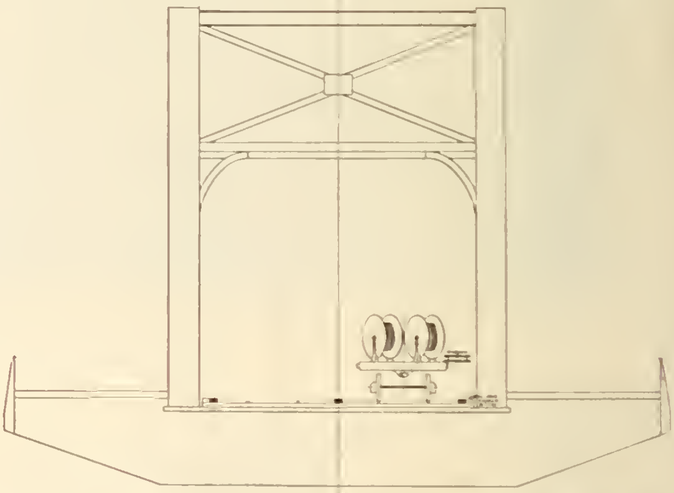

FIG. 6.—CROSS SECTION OF VICTORIA JUBILEE BRIDGE, SHOWING APPARATUS USED FOR LAYING CABLE.

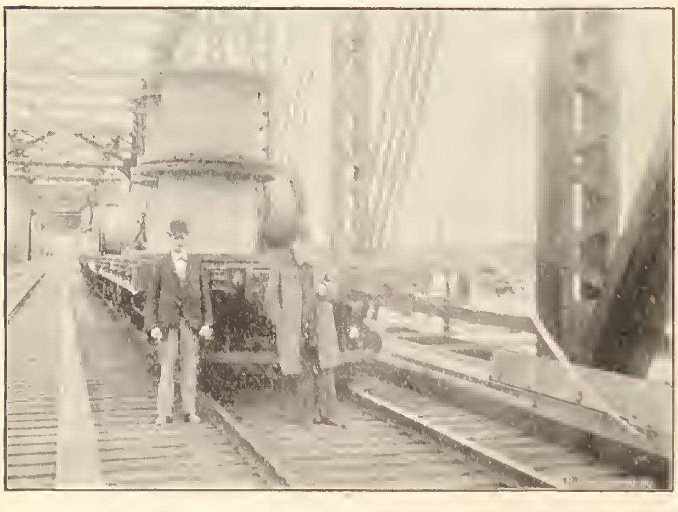

FIG. 4—SHOWING CABLES BEING PAID OUT.

An electric plant owned by Mr. Keith and stored in the building of the Iroquois waterworks at Iroquois, Ont., was burned on June 27th. The loss is about $2,000.

Of the many catalogues which reach our desk, none are more attractive and carefully compiled than those issued by the Sprague Electric Company, of New York, and sent us by their Canadian agents, Messrs. Jack & Robertson, of Montreal. These include the Lundell Motor Catalogue No. 65, the Lundell Fan Motor Catalogue No. 66, Catalogue No. 63 of the Greenfield Flexible Metallic Conduit, Catalogue of Electric Motors for Printing Establishments, and the Architects and Engineers Electrical Bulletin. Besides the numerous illustrations of the many lines of electrical goods manufactured by the Sprague Company, these booklets contain valuable tables and articles of interest to all users of such apparatus.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, AUGUST 5, 1899.

ANOTHER TRANSMISSION PROJECT.

A RUMOR is abroad to the effect that a syndicate is to be formed for the purpose of installing an electric plant at Beauharnois to generate and transmit current for light and power to Montreal. Level-headed business men express the opinion that there is no room at present in this city for additional enterprises of this character.

STREET RAILWAY ENTERPRISE.

The Montreal Street Railway Co. have organized a band of musicians to accompany trolley excursions, which are a favorite form of pleasure-taking in this city on summer evenings. The band occupy a car specially suited to their requirements, and head the procession. Another innovation is a car with the words "Baseball To-morrow," formed of incandescent lamps, appearing in three lines across the front.

THE LACHINE RAPIDS HYDRAULIC AND LAND COMPANY.

This company are fitting up a building on Chenneville street as a sub-station, with steam boilers, engines and two rotary transformers, from which both direct and alternating current will be supplied. Direct current is required for lighting the Temple building. The steam plant will not be used except in the event of the operation of the generating plant at Lachine being interfered with by ice, as was the case last winter. The wind blowing in a direction contrary to the flow of the water caused the blocking up of the tail race with ice. This, in conjunction with the frazil ice which formed on the surface, greatly reduced the head of water and in like degree the supply of current. To avoid a recurrence of this difficulty, the company are now constructing a groin, which is expected to prevent the blocking of the tail race by ice. Steps are also being taken to overcome the difficulty arising from anchor ice.

MEETING OF ROYAL ELECTRIC SHAREHOLDERS.

The annual meeting of the sharehalders of the Royal Electric Company was held in Montreal on July 18th. The manager, Mr. W. H. Browne, made some explanations in regard to the operations of the company since its inception and during the past year. He explained that, in the electrical business, inventive genius was so prolific that the plant or apparatus for manufacturing electricity soon became obsolete. Hence, during the existence of this companv $1,800,000 of equipment had become useless, or superseded by improved machinery and methods. The whole of that $1,800,000 had not been written off, but $600,000 to $800,000 had, and, while there was certainly a million dollars in the nominal assets which was really not in existence for any practical purpose, he thought the proper thing to do was to distribute the loss over a number of years, as they had been doing. Speaking of underground conduits, Mr. Browne said the time was coming, and soon they must meet the necessity. The cost of total conversion from pole wiring to conduits would be $1,500,000, but entire conversion was not necessary, as in some of the residential quarters it was not called for. He explained that, notwithstanding the large outlay for conduits, the expenses of maintenance would be sufficiently reduced to pay the interest on the outlay. He said the atmosphere of Montreal had been filled for some years not only with electricity, but with the idea that electricity would be made for almost nothing, especially when the Lachine Rapids commenced doing their work. However, this idea had been, to some extent, exploded. The Lachine Company were stiffening their prices.

The annual statement presented showed the gross receipts for the year to be $1,113,770.87, and the expenditure for labor $791,486.58, leaving a balance of $322,284.29. After deducting interest and fixed charges amounting to $54,600.11, the net revenue for the year was $267,684.18. During the year $38,603.33 was spent on factory equipment and $84,782.03 on lighting stations, lines and general construction. The report stated :

"With contracts now in hand for motive power and the increasing favor with which the use of electric power is regarded, it seems reasonable to anticipate that during the coming year there will be fully, if not more than, 2,500 horse power in capacity additional demand for current for motors from the alternating current system. Since May 31st, 1899, there has been connected with the alternating current system and now in continuous service, an electric motor of 450 horse power capacity operating a pump in the St. Cunegonde pumping station of the Montreal Water and Power Co., for the supply of water to the citizens of the municipalities adjoining this city. This is the largest electrically driven pumping plant so far established in the world. The "S.K.C." motor performing this work was built in the shops of and supplied by this company. A large number of contracts for lights and motors at present in hand are for periods of five or more years. The alternating current system for lights and motors is now operated by electric current obtained from the water power generating plant, recently completed, of the Chambly Manufacturing Company, on the Richelieu river, opposite Chambly Canton. This plant, both at the generating station and receiving station, has all been equipped by "S.K.C." apparatus made in the shops in this city of this company. The four "S. K. C." generators installed in the power house at Richelieu, each of 2,650 horsepower capacity, the largest machines of the kind ever made anywhere, indicate the extensive character of the equipment and the great manufacturing capacity of the factory."

The following directors were elected : President, Lieut.-Col. J. A. Strathy ; vice-president, Mr. R. Forget ; directors, Messrs. J. R. Meeker, James Wilson, A. Brunet, F. L. Beique, David Morrice, H. B. Rainville.

NOTES.

Owing to the illness of Mr. Rough, who is in charge of Mr. R. E. T. Pringle's shipping warehouse on Craig street, Mr. A. E. Payne, travelling representative, has recently been temporarily discharging the duties of the position.

The names of three of the leading hotels, formed of incandescent lamps, shine out conspicuously every night from the tops of the buildings. Several of the stores show attractive signs of the same character. In fact, electricity is coming more and more into use in this city for advertising purposes.

Messrs. Fred Thomson & Co., who make a specialty of repairing electrical apparatus, have recently removed from Chenneville street to No. 744 Craig street. They now occupy improved premises and a better location. They have entered into a contract with the Wagner Co. to keep in repair several hundred Wagner transformers installed in this city.

Mr. R. E. T. Pringle has recently opened a new shipping warehouse on Craig street—a four-story building which has been fitted up for this purpose, the stock being carefully classified and compactly arranged. The retail store on St. James street will be continued as heretofore. The Craig street establishment is in charge of Mr. Rough, who, I regret to say, has of late been incapacitated through illness.

PERSONAL.

Mr. Henry W. True has resigned his position as manager of the Peoples Light, Heat & Power company, Halifax, N.S., and has been succeeded by Mr. Robert Baxter.

Mr. Donald Robertson, who has been identified with the Grand Trunk Railway for some time, has resigned, to accept a position with the Montreal Street Railway as assistant to Mr. F. L. Wanklyn, the manager.

Mr. Harry Dalton, who at one time resided in London, Ont., has recently been appointed superintendent of the Akron Traction & Electric Co., which operates lines between Cleveland and Akron and from Akron to Kent.

Mr. Nelson Graburn, assistant superintendent of the Montreal Street Railway, is about to remove to Glasgow, Scotland, having accepted the position of superintendent of the Glasgow Corporation Tramways. Mr. Graburn had charge of the electrical equipment of the Montreal road. He has recently invented a system for thawing frozen water pipes by means of electricity.

Major John Williams, gas and electric light inspector for the London district, who died at London on June 24th, was in his 73rd year, and was widely known and much esteemed. He was born in Birmingham, Eng., and served twenty-one years in the Royal Artillery. He came to Canada in 1865, served during the Fenian Raid of 1866, and was promoted to the office of Major, retiring nine years ago. Mr. Williams served the city of London as an alderman, retiring in 1880, when he was appointed gas inspector. When the electrical inspection department was organized, he undertook these duties for his district in connection with that of gas.

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The ELECTRICAL NEWS will be mailed to subscribers in the Dominion, or tbe United States, post free, for $1.00 per annum, 50 cents for six months. Tbe price of subscription should be remitted by currency, registered letter, or postal order payable to C. H. Mortimer. Please do not send cbeques on local banks unless 25 cents is added for cost of discount. Money sent in unregistered letters will be at senders' risk. Subscriptions from foreign countries embraced in tbe General Postal Union $1.50 per annum. Subscriptions are payable in advance. Tbe paper will be discontinued at expiration of term paid for if so stipulated by tbe subscriber, but where no sucb understanding exists, will be continued until instructions to discontinue are received and all arrearages paid.

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Correspondence is invited upon all topics legitimately coming witbin tbe scope of bis journal

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Automobiles in Postal Service. WE observe that the Dominion supplementary estimates contain an appropriation for an automobile mail service between the post-office and the Union depot in Toronto. It is understood that a test has been made of a wagon propelled by electricity with a view to adopting that motive power, and that the results were very satisfactory. In the past the advocates of automobiles have experimented more with gasoline and oil than with electricity, probably owing to the greater simplicity of the former. At the present time it would appear as though electricity was about to take the lead, and that it would become more generally used for the propulsion of street vehicles. The former heavy battery has given place to one which is much lighter in construction and at the same time more rigid. It is worthy of note that the battery invented by Mr. Still, of Toronto, has been favorably commented upon by experts as meeting all the requirements equally as well, if not better than any yet invented. This battery is used in the vehicles manufactured by the Canadian Motor Syndicate.

Electrically Propelled Barges. THE great amount of space occupied in steam barges by the boilers and engine has caused British merchants to turn their attention to the substitution of electricity for steam for their propulsion. A Birkenhead manufacturing firm has, as a result, recently equipped a new vessel with electric power, and has thereby greatly increased the carrying capacity of the vessel. The vessel is claimed to be the largest one electrically propelled in the world, being 75 feet long. The battery consists of 112 Headland storage cells, each of 29 plates, 9¼ in. high by 12 in. broad and one-half inch thick, separated by ebonite separators and placed in a lead-lined box, 16 x 21 x 14 inches. The complete cell weighs four cwt., and has a capacity of 2,000 ampere hours at a nominal discharge rate of 300 amperes. The vessel is propelled by a twin-screw propeller worked by two 40 h.p. electro-motors, each taking a current of 150 amperes at a pressure of 200 volts. A Hopkinson series-parallel controller is used for varying the speed of the vessel. This is manipulated by the steersman, and has five notches from slow to full speed. A reversing switch permits the vessel to proceed ahead or astern at each speed as desired. There is a winch or small crane on board, worked by an 8 h.p. electric motor, and taking 30 amperes at 200 volts. It has a separate controller with three speeds. It is said that the vessel greatly surpasses in speed boats of equal size propelled by steam.

The Orillia Power Plant. MORE than ordinary interest has been shown in the project to transmit electric current from Ragged Rapids to the town of Orillia, for two reasons—first, that it is the first long distance electrical power transmission in America, if not in the world, to be undertaken by a municipality, and, second, in view of the original intention to use aluminium wire for conducting purposes. The contract for the entire plant was let in January last, since which time very little progress has been made. A few weeks ago the contractors, finding themselves unable to carry out the work, withdrew from the field, and placed the council under obligation to re-let the contract. Just as we go to press it is learned that the award has been made to Mr. P. H. Patriarche, of Toronto, at the sum

of $71,000, while the original contract price was $65,-000. Mr. Patriarche has given ample security, and has agreed to have the plant ready for operation by December 1st next and to substitute copper for aluminium wire. In all probability the electrical and hydraulic apparatus will be of Canadian manufacture. The progress of the work will now be watched with keen interest, as the contractors have little enough time in which to complete the undertaking, more particularly as the transmission line must necessarily pass through a rough section of country. The members of the council are no doubt well satisfied that copper is to be substituted for the proposed aluminium wire, as the efficiency and utility of that material is a known quantity; on the other hand, it is to be regretted that this opportunity to prove the advantages or otherwise of aluminium conductors is to be lost. With copper steadily advancing in price, the electrical interests should foster any step looking to the substitution of a cheaper material with equally good conducting qualities, and thus encourage the development for electrical purposes of the many valuable water powers of Canada.

Niagara Falls Power Development.

ATTENTION is again directed to Niagara Falls, owing to steps having been taken during the past month which are likely to result in the further development of that immense power. Upon representations made by the Ontario government, the Canadian Niagara Power Company agreed to surrender the monopoly held under the agreement of 1892, in return for certain concessions. That agreement, as is generally known, gave the Canadian Niagara Power Company a monopoly of the water power for practically one hundred years, at a rental of $25,000 per year for the first ten years, afterwards gradually increasing to $35,000 per year. During the intervening seven years absolutely nothing was done towards developing the power. A new agreement with the Canadian Niagara Company has now been entered into, the advantages of which are that it does not embody an exclusive franchise, and that in place of an annual rental a tariff of rates has been decided upon. The company is to pay, for the first 10,000 horse power developed, $15,000 per annum; for the next 10,000 horse power, $1 per horse power per annum additional; for the next 10,000 horse power, 75 cents per horse power per annum additional; for the remaining power developed up to 100,000 horse power, 50 cents per horse power per annum additional. The agreement, which is to remain in force for 50 years, contains clauses giving to the government the right at the end of that period to re-adjust the rental if such a course is considered advisable. Should the government and the company fail to arrive at a satisfactory agreement on this point the change in rental is to be decided by arbitration. At the end of the 50 years the agreement may be continued for two further periods of 20 years, the rentals, in the event of the government not demanding a change, to remain as fixed at present. It will thus be seen that should the company develop only 20,000 horse power, the revenue to the government would be equal to that stipulated in the former agreement, namely, $25,000 per year. The company claim, however, that it is their purpose to develop 100,000 horse power, from which the annual revenue to the government would be $67,500. From the standpoint of the government, therefore, the new agreement would seem to be preferable to the old one. Another point which must be considered is the interests of the cities, towns and villages which might be benefitted by the development of the power. Will the new agreement hasten or retard the commencement of operations? It would seem only reasonable to suppose that the competition which is now made permissible would tend to cause the company first in the field to complete its works, and thus, by supplying the demand for current, shut out competition which otherwise would be encouraged. It is a source of congratulation to learn that within the past week Professor George Forbes, F.R.S., the distinguished electrician of London, Eng., who was consulting electrical engineer for the Cataract Power Company during the construction of its works on the American side, has been in consultation with Mr. Rankine and other members of the Canadian Niagara Falls Power Company relative, it is said, to the transmission of power to Toronto. The statement is given out that it is proposed to develop 100,000 horse power, at a cost of between two and three million dollars, although it is improbable that any definite decision has yet been arrived at. Mr. Forbes has just returned from Egypt, where he spent eight months preparing plans for the development of the water power of the Nile river. He is about to leave for India on a similar mission.

ELECTRICAL MACHINERY IN JAPAN.

THE United States consul at Osaka says that the manufacturers of electrical apparatus in the United States control the Japanese market.

"Electrical engines are imported from the United States, and they are giving general satisfaction. Telegraphic machinery was imported into Japan during 1897 as follows:

United States	$2,301
Great Britain	1,102
Germany	691

"But little came from any other country. The Japanese government owns both the telegraph and telephone service.

"It is said that considerable delay has frequently occurred in the execution of orders from Japan for electrical machinery in Europe, and that, in consequence, the American market has been given the preference, with the result that the superiority of such machinery has been fully established. The more direct communication between the United States and Japan, together with the lowering of overland freights, should stimulate manufacturers of machinery to increased effort for this market."

LIGHTING THE PYRAMIDS BY ELECTRICITY.

A PLAN is now said to be under consideration by the British government for the lighting of the pyramids by electricity, and the installation of an electric power transmission plant of 25,000 horse-power. The plan involves the erection of a power generating plant at the Assouan Falls on the River Nile, and its transmission over a distance of 100 miles, through the cotton-growing districts, where, it is thought, the provision of cheap power from this source will permit the building of cotton factories. Part of the scheme contemplates the lighting, from this source, of the interior corridors of the pyramids, and also the operation of pumping machinery for irrigating large areas of desert lands along the Nile. It is also stated than an American company is likely to receive the contract for this work.

TELEGRAPH and TELEPHONE

REPAIRS TO SUBMARINE CABLES.

By F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E.

One of the most unsatisfactory features in connection with the repair of submarine telegraph cables, more especially in deep water, is the lack of any means of knowing if the line is intact after the two ends of the conductor are connected and whilst the joint and final splice are being made. Unless special precautions are taken, the danger of the cable becoming kinked and broken whilst the operation alluded to is being performed is imminent. To slip a final splice in deep water some hundreds of miles from land, and on arriving in port to find the cable broken, where it was supposed to have been repaired, is mortifying in the highest degree. Happily, such cases are not of frequent occurrence, but the fact of their happening at all is sufficient to suggest the necessity for some preventive measures.

A special type of cable, or the ordinary kind specially prepared, should be provided, a length of which could be kept in readiness to be spliced on to the sea end when the cable is lifted and found O. K. to the shore, when, instead of buoying the old cable, a piece of the special type should be spliced on and paid out to a sufficient distance to insure a good riding cable, which should be buoyed "end up."

Communication with the shore on the other side of the fault being established, and whilst the process of filling in the gap is being proceeded with, the cable in the tank might be cut a flake or two down and the end passed up and spliced to the special cable, so that the latter would take the bottom before the ship reached the cable buoy. The final splice would then be made on the two parts of special cable, which should be free from the springy, objectionable features of the ordinary types that are so liable to become kinked.

A strand cable, such as the 1869 Atlantic type, with a hard serving of spun-yarn applied over the manilla covered wires, would afford an excellent form of special cable and one that could be buoyed "end up" with perfect safety.

As an instance of what has been done in this direction, it may be mentioned that the writer's suggestion in respect to preparing a cable for buoying in the manner indicated was successfully carried out during a deep sea cable repair in 1888.

The cable was a hempen one and was buoyed "end up" in 1800 fathoms and in 1966 fathoms to the westward of longitude 26. On one occasion the buoyed cable was left for three days, during which period it rode out a fresh gale with lumpy sea, conditions which would have told hard on the ordinary type of cable.

If the details of a former repair to the same cable—to the westward of the position named above—during the year 1882 were given, the evidence would amply substantiate the statement here made, that the dangers and difficulties experienced in repairing operations in deep water are due in a very large degree to the type of cable employed.

That the subject is of no ordinary importance is evident from the fact that the repairs to the 1869 Atlantic cable during the year 1882 cost over £100,000.

An account of those repairs would be an interesting and instructive story, but as the subject of the present paper is not of an historical character, the particulars of the operations mentioned can be reserved for a more convenient occasion. The question now is whether the fact of a cable breaking whilst the final splice is being made can be known on board the ship.

Careful bearings of the mark buoys will sometimes indicate that the cable has severed on one side of the bight, as the ship may then drift out of line, but this would not occur if the vessel were bow on to a current setting along the line of cable. It has been a common practice with the writer during repairs to cables in which the working current was sufficient to render the conditions favorable, to use a telephone in circuit with a coil of wire—known as Gott's wire finder—the coil being placed longitudinally against the cable, so that the signals in the latter could be read on the telephone whilst the final splice was being made in the cable, and the fact of the line being intact would be known. But on long cables on which the working current is too feeble to produce inductive effects sufficient to render the signals audible on the telephone, some amplification of this method is necessary, and the following suggestion is therefore submitted.

If when a final splice is being made, a long bight of the cable were coiled around a suitable drum, provided with a coil of insulated wire with a sensative galvanometer in circuit, by using a battery power stronger than the ordinary working current, it would be possible, by means of preconcerted signals from each station, to ascertain on board the ship whether the line were intact or not.

With regard to the coil of cable, there would be no difficulty in straightening it out when the time came for slipping the bight.

In offering these suggestions the writer desires to express his regret that circumstances prevent his entering into details at present, but he hopes in a future communication to submit further particulars on the subject.

Halifax, N.S., June 21st, 1899.

SHORT-CIRCUITS.

Pare & Pare have disposed of the business of the Citizens' Telephone Co., at Granby, Que., to the Bell Telephone Co.

The ratepayers of Almonte, Ont., will vote on a by-law on September 25th next to raise $30,000 for the establishment of an electric light plant.

The Dominion government have just awarded the contract for the construction of a telegraph line on the north shore of the St. Lawrence, from the Romaine river eastward to Baie Chateau, Strait of Belle Isle.

The North American Telegraph Company's line along the Kingston & Pembroke and Bay of Quinte railways has been sold to a syndicate, and Mr. W. Banfield has been appointed manager. The company purpose extending their lines.

The business men in the county of Charlotte, N.B., purpose establishing a telephone line, taking in St. Andrews, Pennfield, Beaver Harbor, Deer Island and other points. Messrs. Connors Bros., of Black's Harbor, and Capt. Samuel Dick, of St. George, are behind the scheme.

During the past twelve months extensive improvements to the Great North Western Telegraph building, corner St. Sacrament and St. Francois Xavier streets, Montreal, have been under way. These are now completed. The building was originally constructed in 1872 by the Montreal Telegraph Co., and was considered one of the most substantial and imposing business structures in Montreal. About one year ago the management resolved to remodel and refit the structure in a manner that would put it abreast of the times. The work was done most thoroughly, but without interfering with the company's business. New systems of drainage, plumbing, lighting and heating have been introduced and an electric passenger elevator put in.

MOONLIGHT SCHEDULE FOR AUGUST.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.40	A.M. 1.30	5.50
2....	" 7.40	" 2.20	6.40
3....	" 7.40	" 3.20	7.40
4....	" 7.40	" 4.00	8.20
5....	" 7.40	" 4.00	8.20
6....	" 7.40	" 4.00	8.20
7....	" 7.40	" 4.00	8.20
8....	" 7.40	" 4.00	8.20
9....	" 7.40	" 4.00	8.20
10....	" 7.40	" 4.00	8.20
11....	" 8.00	" 4.10	8.10
12....	" 8.30	" 4.10	7.40
13....	" 9.10	" 4.10	7.00
14....	" 9.50	" 4.10	6.20
15....	" 10.50	" 4.10	5.20
16....	" 11.00	" 4.10	5.10
17....	" 11.50	" 4.10	4.20
18....	....	" 4.10	3.20
19....	A.M. 12.50	.....	
20....	No Light.	No Light.	.....
21....	No Light.	No Light.	.....
22....	No Light.	No Light.	.....
23....	No Light.	No Light.	.....
24....	P.M. 7.10	P.M. 9.30	2.20
25....	" 7.10	" 10.00	2.50
26....	" 7.10	" 10.50	3.40
27....	" 7.10	" 11.30	4.20
28....	" 7.10	A.M. 12.20	5.10
29....	" 7.10	" 1.00	5.50
30....	" 7.10	" 1.10	6.00
31....	" 7.00	" 2.10	7.10
		Total..	163.10

PROF. R. J. DURLEY.

THE portrait on this page is that of Prof. R. J. Durley, B. Sc. (London), who has recently been appointed to the Chair of Mechanical Engineering in McGill University, Montreal, as successor to Dr. J. T. Nicholson. Prof. Durley received his early education at the Modern School, Bedford, Eng., a school whose history goes back for considerably more than three centuries.

PROF. R. J. DURLEY.

Upon leaving, he entered the engineering department of University College, Bristol, and worked there during the session of 1884-85. While here he secured one of the college scholarships. He gained a Gilchrist scholarship at University College, London, in 1885, and studied there under Dr. Alex. B. W. Kennedy during the sessions of 1885-86 and 1886-7, spending a considerable portion of this time in experimental work in the laboratory at the college.

At the conclusion of the course Mr. Durley took a very high position in all the college examinations in professional subjects, and in 1887 he passed the examination for the degree of Bachelor of Science of the University of London. On leaving University College he entered the works of Earles' Shipbuilding and Engineering Company, Ltd., of Hull, and served a term of four years apprenticeship as a mechanical engineer. During this time Mr. Durley spent some months working on board those ships of the Royal Navy then being engined by Earles' company in H. M. dockyards at Pembroke and Devenport. From 1890 to 1894 he remained in the service of the same firm, and was employed in designing marine and other machinery of varied types.

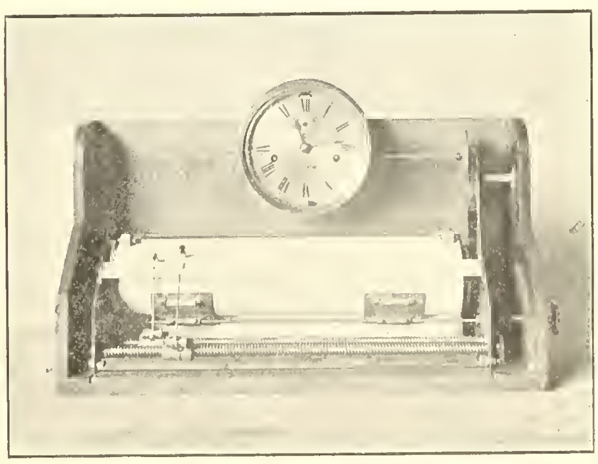
In 1894 Mr. Durley was appointed chief lecturer on mechanical engineering in the Hull Municipal Technical Schools, which were then being established, and he was responsible for the arrangement, organization and equipment of the workshops and laboratories of his department. In 1897, on accepting the appointment of assistant professor of mechanical engineering in McGill University, he came to Canada.

Prof. Durley is a Whitworth scholar and has on two occasions received Miller prizes for papers presented by him to the Institution of Civil Engineers (England), of which society he is an associate member. He is also an associate member of the Canadian Society of Civil Engineers, and has been a not infrequent contributor to the proceedings of that body. The work done for McGill University by Mr. Durley, as Dr. Nicolson's assistant, received academic recognition last year, when the degree of Master of Engineering was conferred upon him by the university.

THE MARTIN AUTOMATIC REGISTER.

THE accompanying cut shows the Martin Automatic Register. It is the invention of Mr. F. W. Martin, station superintendent for the Hamilton Electric Light & Power Co., Hamilton, Ont. The register is for plotting the load curves of the different outputs of a station. The illustration shows two pens working over a scale of amperes. The pens use different colored inks, which makes them distinct and easy to trace. One can be plotting an incandescent while the other is plotting a power load. Besides being a reference for the office and to keep on file, it is a check on the switch-board attendant, as the charts move over a roller which is geared to a clock and keep the charts moving at the same rate as time ; the pens resting on the chart record the load, and can be moved from left to right according to the variations. The charts are laid off in 15 minute readings unless otherwise wanted. The attendant cannot record the readings, as is sometimes done, by jotting down several readings from memory, and if the load does not change a key at one side is knocked down, and will mark the chart at that time, proving that he was on duty. The register carries a supply of charts which are on a roller under the large roller, and are either passed out at the back or rolled on to a third roller, if desired, and taken out when putting in a new supply of charts. The register can then be locked up by the foreman or superintendent, and the attendant can only get access to refill the pens, which will run about a week without refilling.

Mr. Martin has given the work of designing the new model to Mr. W. A. Turbayne, and when finished with



THE MARTIN AUTOMATIC REGISTER.

the improvements, it will look very neat and attractive, fitted with a Seth Thomas eight-day clock, and finished in white nickel plate. Patents have been applied for in several countries.

The accompanying cut shows the one that was in operation at the Hamilton Electric Light & Power Co.'s station during the Canadian Electrical Association convention. Its usefulness was readily appreciated, and several orders were placed. As one well known station manager put it, " No station can afford to be without one."

Henry Sheldon, of Aylmer, Ont., is negotiating for the right to manufacture a motor carriage in Canada.

Forms Accompanying Paper on

CENTRAL STATION ACCOUNTING

From a Business Standpoint.—By P. H. HART.*

SUBSIDIARY LEDGER.

Form No. 1.

GENERAL CONSTRUCTION.

INCANDESCENT INSTALLATION

DATE.		Real Estate and Buildings.	Office Furniture and Fixtur's	Maps, Instruments and Drawing		House Connecti'ns	Placing Transformers.	Placing Meters.	Meters Located	Transformers Located	Interior Wiring	TOTAL
1895 JUNE ...												
JULY ...												
AUGUST												
SEPT....												
OCT. ...												
NOV. ...												
DEC. ...												
1896 JAN												
FEB......												
MAR. ...												
APRIL...												
MAY ...												
1896 JUNE ...												
JULY ...												
AUG. ...												
SEPT.												
OCT. ...												
NOV......												
DEC. ...												
1897 JAN												
FEB												
MAR. ...												
APRIL ..												
MAY ...												
1897 JUNE ...												
JULY ...												
AUG. ...												
SEPT....												
OCT. ...												
NOV. ...												
DEC. ...												
1898 JAN												
FEB												
MAR. ...												
APRIL...												
MAY ...												

Original size of Form, 11 x 14 inches.

* This paper was read at the recent convention of the Canadian Electrical Association, and was published in the last issue of the ELECTRICAL NEWS.

Form No. 2

Class of Account—GENERAL CONSTRUCTION.

Date.	Account.	Sub-Account.	Labor.	Material.	Total.
	Real Estate and Buildings				
	Office Furniture and Fixtures				
	Maps, Instruments and Drafting				
	Incandescent Installations	House Connections.			
		Placing Transformers.			
		" Meters.			
		Meters Located.			
		Transformers Located.			
		Interior Wiring.			
	Alternating Arc Installations	House Connections.			
		Placing Transformers.			
		" Meters.			
		" Lamps.			
		Meters Located.			
		Transformers Located.			
		Interior Wiring.			
		Lamps and Coils Located.			
	Arc Installations, City	Connections.			
		Lamps and Fixtures Located.			
		Placing Lamps and Fixtures.			
	Arc Installations, Commercial	House Connections.			
		Lamps and Fixtures Located.			
		Placing Lamps and Fixtures.			
	Series Inc. Installations, City	Lamps and Fixtures.			
		Connections.			
	Series Inc. Installations, Comm'l	Lamps and Fixtures.			
		Connections.			
	D.C. Motor Installations	House Connections.			
		Inside Connections.			
		Meters Located.			
		Placing Meter.			
	A.C. Motor Installations	House Connections.			
		Placing Transformers.			
		Transformers Located.			
		Placing Meters.			
		Meters Located.			
		Interior Wiring.			
		Placing Motors.			
	Lines and Poles	Incandescent.			
		Arc, City.			
		Arc, Commercial.			
		D. C. Motor.			
		A. C. Motor.			
		Alternating.			
	Subways and Conduits				
	Cables	Incandescent.			
		Arc, City.			
		Arc, Commercial.			
		Motor.			
	Tools	Incandescent.			
		Arc.			
		Motor.			
		Linemen's.			
		General.			
	Horses and Wagons				

Original Size of Form, 8 × 11 inches.

Form No. 3.

Class of Account—STATION CONSTRUCTION

Accounts for Each Station.

Date.	Account.	Sub-Account.	Labor.	Material.	Total.
	Real Estate and Buildings				
	Steam Plant	Boilers.			
		Piping.			
		Engines.			
		Pumps, Condensers and Heaters.			
		Shafting aud Pulleys.			
		Belting.			
	Electric Plant	Incandescent Dynamos.			
		Incandescent Switchboard and Instruments.			
		Incandescent Switchboard Connections.			
		Arc Dynamos.			
		Arc Switchboard and Instruments.			
		Arc Switchboard Connections.			
		D. C. Motor Dynamos.			
		D. C. Motor Switchboard and Instruments.			
		D.C. Motor Switchboard Connections			
		Motors (in Station).			
	Station Tools	Steam Plant.			
		Electric Plant.			
		General.			
	Office Furniture and Fixtures				
	Testing Equipment				
	Interior Wiring				

Original Size of Form, 8 × 11 inches.

Form No. 4.

Class of Account—STATION OPERATING

Accounts for Each Station.

ACCOUNT.	SUB-ACCOUNT.
Rent	
Taxes	
Insurance	
Steam Plant	Fuel.
	Cartage of Ashes.
	Boiler Compound.
	Water for Boilers.
	Boiler Room Wages.
	Engine " "
	Oil and Waste.
Electric Plant	Inc. Dynamo Tenders' Wages.
	Arc Dynamo Tenders' Wages.
	D. C. Motor Dynamo Tenders' Wages.
	Incard. Switchboard Tenders' Wages.
	Arc Switchb'd Tenders' Wages.
	D. C. Motor Switchboard Tenders' Wages.
	Inc. Dynamo Brushes.
	Arc Dynamo Brushes.
	D. C. Motor Dynamo Brushes.
	Incand. Commutator Segments.
	Arc Commutator Segments.
	D. C. Motor Commutator Segments.
	Arc Blower Wings.
Arc Lamps, City	Oil and Waste.
	Carbons.
	Trimming.
	Inspecting.
Arc Lamps, Commercial	Carbons.
	Trimming.
	Inspecting.
Alternating Arc Lamps	Inspecting.
	Trimming.
D. C. Motor	Inspecting.
	Testing.
A. C. Motor	Inspecting.
	Testing.
Incandescent	Inspecting.
	Testing.
Lamp Renewals	Incandescent.
	Series Inc. City.
	Series Inc. Commercial.
Incandescent Lamp Changes	
Lines and Poles	Inspecting.
(to be subdivided where possible)	Testing.
Removing Lines and Poles	Incandescent.
	Arc, City.
	Arc, Commercial.
	Motor.
Removing Installations	Arc, Commercial.
	Arc, City.
	Incandescent.
	D. C. Motor.
	A. C. Motor
	Alternating Arc.
	Series Inc., City.
	Series Inc., Commercial
Fire Patrol	Arc, City
	Arc, Commercial.
	Incandescent.
	Motor.
Testing (in Station)	Inc. Lamps
	Meters.
	Alt. Arc Lamps.
	General.
Accidents	
General Expenses	Clerks.
	Stationary
	General

Original Size of Form, 8 × 11 inches.

Form No. 5.

Class of Account—STATION MAINTENANCE

Accounts for Each Station.

ACCOUNT.	SUB-ACCOUNT.
Real Estate and Buildings	
Steam Plant	Boilers.
	Piping.
	Engines.
	Pumps, Condensers and Heaters.
	Shafting and Pulleys.
	Belting.
Electric Plant	Arc Dynamos.
	Arc Switchboard and Instruments.
	Arc Switchboard Connections.
	Arc Lamps in Station.
	Incandescent Dynamos.
	Incand. Switchboard and Instruments.
	Incandescent Switchboard Connections.
	Incandescent Lamps and Circuits.
	D.C. Motor Dynamos.
	D.C. Motor Switchboard and Instruments.
	D C. Motor Switchboard Connections.
	Motors.
Lines and Poles	Incandescent.
	Arc, City.
	Arc, Commercial.
	D.C. Motor.
	A.C. Motor.
	General.
Installations Inc	House Connections.
	Repairing Meters.
	Repairing Transformers.
	Replacing Transformers.
	Customers' Premi es.
Inst. Alternating Arc	House Connections.
	Repairing Meters.
	Repairing Transformers.
	Customers' Premises.
	Lamps.
	Globes.
Inst. Series Inc. Commercial.	Lamp Fixtures.
	Lamp Connections.
Inst. Series Inc. City	Lamp Fixtures.
	Lamp Connections.
	Lamps.
Installations Arc City	Lamp Fixtures.
	Lamp Connections.
	Globes.
Inst. Arc Commercial	Lamps.
	Lamp Fixtures.
	Lamp Connections.
	Globes.
Installations D.C. Motor	House Connections
	Customers' Premises.
	Repairing Meters.
Installations A.C. Motors	House Connections.
	Repairing Meters.
	Repairing Transformers.
	Customers' Premises.
	Motors.
Tools	Steam Plant.
	Electric Plant.
	Testing
	General.

Original Size of Form, 8 × 11 inches.

REQUISITION FORM

Form No. 6.

"Line Construction and Maintenance Dept." No.......... .....

....189

Stores Dept. will please CHARGE to...*for order No*............

To be CHARGED

Blocks, Side
Bolts, Carriage, ⅜ x 4
" " ½ x 5
" " ½ x 7
" Machine, ⅜ x
" " " x
" " " x
" " ½ x
" " ½ x
" " ½ x
Brackets, Cross, 2 pin
" Flat, 2 pin
" Hook, with nut
" Leg
" 3 "
" Straight, 1 pin
" " 2 "
" " 1 " with nut
" " 2 " "
Braces for cross arms
Boxes, Junction
Cable
"
Cement, Roof
Charcoal
Cross arms, 2 pin
4 "
6 "
Cut outs, Film
Globes
Hanging Straps
Hangers, Iron Street
" Goose-neck
Hoods, Series Inc.
Insulators, Guy
Ordinary
D. P.
Porc.
Lamps, double arc, 2000 c.p.
" Single arc, 2000 c.p.
" Series 32 c.p., 9.6 amp.
" " 65 c.p., 9.6 amp.
Naphtha
Outriggers
" Plates
Pins, Oak
Poles, ft.
" "
" "
" "
" "
Rope, Manilla
Resin
Screws, Wood
" "
" "

Forward,

Forward,

Screws, Coach
" "
" Cap
Slings, rope
Solder
Spikes
Tape, Grimshaw
" Kerite
Transformers, Light No.
" " "
" " "
" " "
" " "
" " "
Turn Buckles
Tubing
Tripods
Washers, 5-16
" 7-16
" 9-16
" 13-16
Wire, Rubber Covered
" " "
" " "
" " "
" D. B. 4/0
" " 3/0
" " 2/0
" " 0
" " 1
" " 2
" " 4
" " 6
" " 8
" " 10
" " 12
" " 14
" " 16
" Cable
" "
" "
" Galv'd, 6
" " 9
" " 9 x 2 strand
" " 9 x 3 "

Received
Delivered by
D. B. Folio

Original Size of Form, 8 x 11 inches.

CREDIT

Form No. 6

No .... "Line Construction and Maintenance Dept."

.. ..189

Stores Dept. will please CREDIT to ....*for order No*........ . .

To be CREDITED

Blocks, Side
Bolts, Carriage, ⅜ x 4
" " ½ x 5
" " ½ x 7
" Machine, ⅜ x
" " " x
" " " x
" " ½ x
" " ½ x
" " ½ x
Brackets, Cross, 2 pin
" Flat, 2 pin
" Hook, with nut
" Leg
" 3 "
" Straight, 1 pin
" " 2 "
" " 1 " with nut
" " 2 " "
" Strap
Braces for crossarms
Boxes, Junction
Cable, Lead-concentric
"
"
"
Cement, Roof
Charcoal
Crossarms, 2 pin
" 6 "
" 10 "
Cut-outs, Film
Hanging Straps
Insulators, Glass, Small
" Ordinary
" D. P.
" Porc.
Naphtha
Outriggers
" Plates
Pins, Oak
Poles, ft.
" "
" "
" "
" "
Rope, Manillla
Resin
Screws, Wood
" "
" "
" Coach
" "
Screws, Coach
Solder
Spikes

Forward,

Forward,

Spikes
Tape, Grimshaw
" Kerite
" Okonite
Transformers, Light No.
" " "
" " "
" " "
" " "
" " "
" Straps
" Stays
" Tables
Tubing

Tripods

Washers, 5-16
" 7-16
" 9-16
" 13-16
Wire, Rubber Covered
" " "
" " "
" " "
" D. B. 4/0
" " 3/0
" " 2/0
" " 0
" " 1
" " 2
" " 4
" " 6
" " 8
" " 10
" " 12
" " 14
" " 16
" Cable
" "
" "
" Galv'd, 6
" " 9
" " 9 x 2 strand
" " 9 x 3 "

Received
Delivered by
D. B. Folio

Original Size of Form, 8 x 11 inches.

REQUISITION FORM.

Form No. 6.

Requisition No. **B** ....

Montreal..*189*

On General Manager's Order No.........................

	Class of Account.	Account.	Sub-Account.
For.............. Debit .... Credit			

Received by.. *189* .... *Foreman*

Delivered by.. .... *Supt.*

D. B. Folio... .... *For use in*.. *Dept.*

Posted ....

Original size of Form, 8 x 10 inches.

Form No. 6.

CREDIT.

Requisition No. **C** ....

Montreal..*189*

On General Manager's Order No.........................

	Class of Account.	Account.	Sub-Account
For.............. Credit			

Received by ....*189* .... *Foreman.*

Delivered by.. .... *Supt.*

D. B. Folio .... *For use in*.. *Dept.*

Posted..

Original size of Form, 8 x 10 inches.

Customers' Record Book Form.

INCANDESCENT

For Month Ending June, 1899.

Cir. No.	Led. Folio.	NAME.	Date.	METER READ'G IN AMPERE HRS Present.	METER READ'G IN AMPERE HRS Consumed.		Meter Rental.	Total	Led Folio	Date

Original size of Form, 23½ x 18 inches.

Form No. 8.

LIGHTING DEPARTMENT.

Ledger Folio.	Ck.	Customer.	Discount. Incand.	Discount. A. C. Motor	Totals.	Lighting Incand.	Lighting Com. Arc	D. C. Motor Current	D. C. Motor Rental.	Sales

Original size of Form, 20 x 15 inches.

Note.—The Customer's Record Book Form and Form No. 8 should be read across the two pages.

Form No. 7.

CARD........................

INCANDESCENT METER CARD.

LED. FOL............ CONTRACT NO...... ....DATE...

DATE OF CONNECTION .............................TERM...............EXPIRES....... ....

NAME...

ADDRESS ....

BUSINESS...

REMARKS ....

....

METER NO.......................................CAP.......................................AMPERES

GOV. CERT. ....PER CENT. OF ERROR.......................................

CIRCUIT NO......................................VOLTS..

Lamps Installed.

DATE.	ORDER.	5 C.P.	8 C.P.	10 C.P.	16 C.P.	32 C.P.	C.P.	TOTAL EQ. TO 16 C.P.

Original size of Form, 8 x 4½ inches.

Original size of Form, 8 x 4½ inches.
(Back of Incandescent Meter Card).

METER NO.......................... VOLTAGE.......................... RATE..........................

REMARKS.	DAYS				CURRENT REGIST'D	READING.	DATE.	INSP.

Manager's Order Form.

NAME.. ORDER NO.........................

ADDRESS .... DATE.....................................

....

THIS ORDER AUTHORIZES AND DIRECTS THAT ....

....

....

....

....

....

....

SIGNED...GENERAL MANAGER

Return this Order as soon as completed, and report labor, material and expenses on following accounts.

CLASS OF ACCOUNTS.	ACCOUNT.	SUB-ACCOUNT.	Station	No. of Circuit.	

TO..

REPORT HERE, REMARKS, ETC.

....

....

....

....

....

....

WORK COMPLETED, DATE ....

SIGNED BY..

Original size of Form, 8 x 11 inches.

LIGHTING ACCOUNTS

July, 1899.								August, 1899.								
METER READ'G IN AMPERE HRS. Present.	Consumed.					Meter Rental.	Total.	Led. Folio.	Date.	METER READ'G IN AMPERE HRS Present.	Consumed.				Meter Rental.	Total.

CASH RECEIPTS.

CONTRACT AND SALES.			A. C. MOTOR.			RENTAL.			MISCELLANEOUS.	TOTAL.
Wiring.	Lamp Renewals.	Line Construction.	Current.	Rental.	Sales.	A.A. Lamps.	Transformers.	Poles.		

AN INTERESTING LEGAL DECISION.

Mr. Justice Davidson recently gave his decision in the Superior Court at Montreal in an interesting case in which the Royal Electric Company were plaintiffs and Mr. Maurice E. Davis defendant. His judgment in full was as follows :

The Royal Electric Company vs. Maurice E. Davis, et al.—From the 20th of August, 1895, to the 20th April, 1898, plaintiffs supplied defendants with electric light for their premises situate on the corner of Dalhousie and Ottawa streets. Monthly accounts were rendered and paid up to the 25th of December, 1897. About the 1st of February following defendants were notified that a wrong principle had been followed in calculating the meter readings, and that the resulting under-charges amounted to $1,384.35, payment of which was asked for. The accounts for the current and following months were made on the altered basis of calculation. Defendants denied the existence of any error, and positively refused to reopen past settlements. To avoid litigation, however, and in view of the fact that but a short life remained to the contract when the dispute arose, they offered to acquiesce in plaintiff's pretensions as to the future. This was refused, and then came the present suit to recover $1,874.05. By way of defence, it is pleaded that the accounts, as closed up to the 25th of December, 1897, were in accordance with the contract, and that the tender of $423.40 made for the sake of peace and now renewed was more than sufficient to cover any lawful indebtedness. By the contract between the parties, defendants agreed to take and use for a term of not less than twelve months 175, or more, incandescent lamps, the installation of which was to be at their expense. The electric company was to furnish its own meter at a rental of 25 cents per month. Then appear covenants in the following words :

"Said lights to be supplied by meter, and we hereby agree to pay for the same at ¾ cent per ampere hour, the bill to be rendered monthly, which we agree to pay upon the 15th of each and every month, for the preceding month's lighting at the company's office in this city. * * * * * Should the meter cease to register through any defect in its manufacture or break in its mechanism, the Royal Electric Company reserves the right to charge for such period of non-registry at the same rate as that at which the meter was registering at the time of such break or interruption." The accounts rendered stated the last and current readings of the meter, and multiplied the difference by ¾ of a cent. The result, plus 25 cents for rent of meter, represented the monthly charge. I take as an example the invoice for the first month :—

For electric lighting from August 21, 1895, to September 25, 1895 :—

Present meter register	35,800
Previous meter register	33,650
Ampere hours registered	2,150
At ¾ cent per hour	$16.13
	.25
	$16.38

Now, according to plaintiff's pretensions, the ampere hours registered ought, in this and all subsequent accounts, to have been doubled before being multiplied by the price. The effect would have been to double all the monthly statements. I take as an example the first account which was tendered after the alleged mistake of calculation had been discovered :

For electric lighting from December 2, 1897, to January 25, 1898 :—

Present meter register	34,450
Previous meter register	25,610
Ampere hours registered	8,840
	2
	17,680
At ¾ cent per hour	$132.60
Rent of meter, one month at 25c. per month	.25
	$132.85

How plaintiffs justify this doubling up of the registered ampere hours calls for an explanation of a somewhat technical kind.

A transformer of 104 volts capacity transmitted a secondary current from plaintiff's main wires into the premises covered by the contract. Shallenberger meter within the building registered the ampere hours. Both transformer and meter had been in use during the previous occupancy of a firm of D. Ritchie & Co., among the partners in which were the present defendants. With but few exceptions, the company had in use 52 volt transformers. The company's inspectors, in their reports, made no mention of the voltage, if it were 52 ; they were expected to do so, if it were 104. Presumably from the facts that the transformer was not changed and that while in use by D. Ritchie & Co. two reports had been made of its voltage, the meter readings were returned to the office without special mention of the voltage. The chief clerk of the accounts department states that he, as a consequence, tendered statements on a 52 volt basis, and only in December, 1897, was it reported to the office that a 104 volt transformer was in use. Five or six weeks later the fact and pretended consequences were notified to the defendants. M. E. Davis gives the following account of the interview : "One of the Royal Electric Co.'s representatives came to our establishment one day and told us he had been making a mistake in our accounts for the last two years. I said, 'that is a strange thing ; I only remarked yesterday that I thought you were making mistakes, I have been complaining of exorbitant charges, the bills are large.' 'Well,' he replied, 'It is not that we have not been charging you enough.' 'Well, I said, 'that is strange, you have been tendering bills monthly, and if I had known that I would not have had the lights :' and they rendered another account for the following month, doubling up the price, which we returned, marked 'not correct.'"

Subsequently, as already stated, defendants, in the hope of avoiding a law suit, offered to acquiesce in the demand for the short time which the contract had still to run. But plaintiffs persisted in the belief that they were entitled to have all past accounts rectified and doubled in amount.

Upon what technical basis the claim rests, and what effect on figures a pressure of 104 volts instead of a supposed pressure of 52 volts produces, may as well be stated in the words of Mr. Gossler, plaintiff's electrical engineer and superintendent. They are as follows :—

"The reason is that if one lamp burned, or a sixteen candle power lamp at fifty volts permits a current to flow, for one hour of one ampere, a sixteen candle power lamp at one hundred volts allows it to flow but one-half ampere per hour, consequently the two lamps giving the same illuminating power will register on an ampere hour meter, in the case of fifty-volt lamps one ampere hour, in the case of a hundred-volt lamp, one-half ampere hour."

The statements do not represent theories, they are well-established scientific facts. But does this full acquiescence entitle plaintiffs to judgment. The answer has to be in the negative, and for a number of reasons.

The contract explicitly says that the lights were to be supplied by meter at ¾ of a cent per ampere hour, and if the meter were to break down, the charge was to be at the same rate at which the meter was registering at the time of such break or interruption.

Plaintiffs now want to base their calculations not on amperage alone, but on voltage also. They want to be paid for the product of quantity, which is called amperes, and of pressure, which is called "volts." The result gives the energy which is called "volts." If this were the true intent of the contract, why was not a constant ratio fixed between voltage and the amperage, as registered by the meter, which was of a standard kind, and in common, indeed, universal use, whatever the transformer might be? Or why not have provided for payment by volts instead of by amperes ?

Mr. Lockart, chief electrician of the Montreal Street Railway, states his opinion in this effective way : "If a man came and said he would supply me current at any price per ampere hour, the voltage does not enter into it."

Plaintiff's interpretation of the contract, even if correct, is thus certainly open to legal and scientific controversy. Having for eighteen months not only acquiesced in, but given effect to the amperage meter readings without reference to voltage, they cannot now have specific performance imposed on defendants. To state a principle well known to the courts, relief will not be given to parties who sleep on their rights. Defendants connection with the dissolved firm of D. Ritchie & Co. does not prejudice their position. Its contract was auxiliary to a local installations, and contains some words not present in the one under consideration, which may or may not be of distinct importance.

Had plaintiffs asserted their present position at the outset, it might have been open to defendants to dispute it more effectively than they can do now, or to have it torn up ; or to certainly cancel at the end of twelve months ; or to handle their lights with greater economy of use. The action is dismissed with costs.

There is a movement on foot at Baddeck, C.B., looking to the installation of an electric light plant.

CANADIAN WATER POWER AND ITS ELECTRICAL PRODUCT IN RELATION TO THE UNDEVELOPED RESOURCES OF THE DOMINION.*

By Thos. C. Keefer, C.M.G.

Amongst the many partially developed resources of Canada, perhaps there is none more widespread or more far reaching in future results than her unsurpassed water power. The value of this has been enormously enhanced, first by the expansion of the wood pulp manufacture, and the introduction of electro-chemical and metallurgical industries for which this country possesses the raw material ; and, more recently, by the revolution which has been brought about by success in transmitting the energy of water falls from remote and inconvenient positions to those where the work is to be done.

Electrical transmission brings the power to the work, and when the prime mover is water, we have the cheapest power, and perhaps nearest approach to perpetual motion which it is possible to obtain—one which is always "on tap," and, like gravity, maintained without cost and applied without delay.

While water power was at first the only substitute for the windmill in new countries, and its economy as well as superiority has always been recognized, several causes have contributed to limit its more general application. Before the invention of the turbine in the first half of the present century, heads exceeding about seventy feet could not be utilized on account of the comparative weakness and excessive cost of wheels of large diameter. In these days of structural steel, and "Ferris" wheels, this difficulty could be overcome ; but, with the turbine the conditions are reversed, the higher the head the less the size and cost of wheels, so that the most valuable water powers were the most cheaply utilized in this respect.

A previous check to the greater extension of water power was given in the latter part of the last century by James Watt's discovery of the steam engine, which by bringing the power to the work, to the city, and to the mine, revolutionized industrial conditions.

A still greater revolution has recently occurred which brings water power to the front again, by its amalgamation with electricity, whereby its economical power is transferred to the work, over many miles of distance upon a single wire.

Within the last ten years high voltage electricity has been firmly established with annually increasing power of extension, and this has brought Canada into the first rank of economical power producing countries. Water is thus represented by a power to which it can give birth, but which is superior to its own, in that, whereever transplanted, it can do nearly all the parent power could do, as well as give light, heat and greater speed ; moreover, it has given rise to industries only possible with abundant cheap electricity. What is more important to us is that such industries are those for which Canada possesses the raw material, but which, without water power, she could not engage in.

There are important industries in which we have for some time utilized water power, for which electricity is not indispensable, but which equally require large amounts of cheap power, and are capable of indefinite extension ; but while these may not need the intense electric current necessary for electro-chemical industries, they will find electrical transmission of inestimable value in many situations ; while, for lighting and heating purposes, water power is invaluable to all.

Heretofore we have cut our spruce into deals and exported it to Europe, and more recently into pulp wood and exported that to the United States, but, manufactured by our water power into paper, the raw material would yield this country ten times the value it is now exported for.

The extension of railways, combined with electrical transmission, will promote the local manufacture of such wood products (including all valuable hardwood) as can bear transportation, thus giving the largest amount of local employment, as well as tonnage to the railway, and delivering us from the position of "hewers of wood" for other countries.

ELECTRICITY.

In order to present more fully the recently enhanced value of our Canadian water power, some reference is necessary to certain properties of electricity, the power which has happily been described as "the most romantic form of energy" by Wm. Henry Preece, C.B.F.R.S., in his recent address as president of the Institution of Civil Engineers.

Inasmuch as the cost of production of electrical energy depends upon continuity of output, water power must be the ideal one for this purpose, at least until some cheaper power is discovered. In some places where steam is now used for electric light, other industries have been added to secure the more continuous use of the power in daylight hours.

The only quality in which any deficiency has been exhibited by electricity is for lighthouse purposes, a lesser power of penetration in fogs, in which respect it is inferior to oil or gas ; but even this has in the present year been more than compensated for by the successful application of "wireless telegraphy," by which, in any weather, communication between the ship and the shore can be established. The shores of the St. Lawrence from the Atlantic to the Lakes are lined with water power which can be used to light, in fair, or protect, in foul weather, the passing vessel, to ring the bell or blow the horn.

When water is applied for light and power purposes, its economy is always the important factor, but it is chiefly to its value for electro-chemical industries that Canada will look to reap the greatest benefits, because in these it is not merely a question of competition of power producers, but one in which intense electricity has the monopoly, and in the case of some of them, as in the production of aluminium, calcium carbide, carborundum, etc., their existence depends upon ample supplies of an intense electric current, for the generation of which abundant and cheap water power is indispensable.

Touching electro metallurgical processes, Mr. Preece says : "Every electrolyte requires a certain voltage to overcome the affinity between its atoms, and then the mass decomposed, per minute or per hour, depends solely upon the current passing. The process is a cheap one and has become general. Three electrical h.p., continuously applied, deposits 10 lbs. of pure copper every hour, from copper sulphates, at the cost of one penny. All the copper used for telegraphy is thus obtained. Zinc in a very pure form is extracted, electrolytically, from chloride of zinc produced from zinc blende, in large quantities. Caustic soda and chlorine are produced by similar means from common salt. The passage of electricity through certain gases is accompanied by their dissociation, and by the generation of intense heat. Hence the arc furnace. Aluminium is thus obtained from cryolite and bauxite. Phosphate is also separated from apatite and other mineral phosphates. Calcium carbide, obtained in the same way, is becoming an important industry. Electrical energy can be generated on a coal field where coal, of good carolific value, is raised at a cost of three shillings per ton, cheaper than by a water fall, even at Niagara."

Eastern and Western Canadian coal fields are separated by thousands of miles, but water power is abundant throughout nearly all this coalless region. Our western coal fields are vast and their market at present limited. If coal can be raised cheaply enough and the raw material for the work be discovered in the neighborhood, they may give rise to electro-chemical and electro metallurgical industries without the intervention of water power.

The commercial production of calcic carbide (acetylene gas), by electrolysis, is the discovery of Mr. T. L. Wilson (a grandson of the late Hon. J. M. Wilson, of Saltfleet, Ont.), who has established works on the water powers of the Welland Canal and has shipped this product all round the world.

The electric production, commercially, of caustic soda

*Abstract from Presidential Address read before the Royal Society of Canada, May 23rd, 1899.

and chlorine is under the patent of Mr. Ernest A. Leseur, son of the Secretary of the General Post-Office Department, Ottawa. This manufacture is now being carried on by a Boston company at a New England water power.

MINING.

There is another field nearly as widespread as our water power in which electricity is destined to play a most important role, and this is mining, which is now spreading over the Dominion with the same rapidity as the utilization of our forests for pulp and paper purposes. Over this area minerals have been discovered and in many cases tested and successfully worked, and from recent results we appear to be on the threshold of remarkable developments in this direction, especially as so small a portion of so great an area has been prospected sufficiently for mining purposes.

For power purposes alone, electricity is invaluable in mines, and its multifarious uses (as enumerated by Mr. Preece) are "for moving trams and for working hoists; it lights up and ventilates the galleries, and, by pumping, keeps them free from water. It operates the drills, picks, stamps, crushers, compressors and all kinds of machinery. The modern type of induction motor, having neither brushes nor sliding contacts, is free from sparks and free from dust. Electric energy is safe, clean, convenient, cheap, and produces neither refuse nor side products." The Canadian mining districts are well supplied with water power, and all the wonderful effects of electricity are available for us upon a larger and more economical scale than elsewhere. In connection with this abundance of water power, and from the fact that a large proportion is at present situated remote from present railways and present settlements, the question of profitable limit of electrical transmission is most important—if, indeed, it be now possible to put a limit on anything connected with electricity, with or without the aid of a wire. If, as reported, Lord Kelvin has placed the profitable limit at 300 miles, this is sufficient to utilize the greater part of the water power upon the two watersheds north of the St. Lawrence river.

Professor Elihu Thomson says, "Up to the present time it was practicable to transmit high pressure currents a distance of 83 miles, using a pressure of 50,000 volts. If a voltage higher than that were used, the electricity would escape from the wires into the air in the form of small luminous blue flames." As showing how far we are yet behind nature, Prof. Thomson says the estimated voltage from a lightning discharge ranges from twenty to fifty million volts.

Wherever the raw material for electro-chemical, electro-metallurgical, or other industries, affords sufficient inducement, and the water power is at hand, the forest will be penetrated much more rapidly than heretofore, and settlements advanced in new directions. What can be done in this direction is best illustrated by the development of a single industry in the wilds of Minnesota north of Lake Superior, and adjoining Canadian territory. Over four hundred miles of standard gauge railways have been built, through what was a trackless wilderness in 1885, to reach iron ore beds, the ore from which is shipped to Lake Erie and thence again railroaded 200 miles into Pennsylvania. This one business has, in mines, railways, docks and fleets of steamers, required an investment of $250,000,000, and has led to as low a rate, by water, as 1 cent per bushel for wheat between Chicago and Buffalo, and 20 cents per ton for coal from Lake Erie to Duluth, nearly 1,000 miles. One-half of the charcoal iron, and more than half of the pig iron made in the United States, is smelted from Lake Superior ore.

ELECTRIC RAILWAYS.

The substitution of electricity for steam as the motive power for railways on many roads is regarded as inevitable sooner or later. It has already taken place as regards suburban railways, notably in the case of the Charlevoix road and Hull and Aylmer railway, where water is doing the work which has heretofore been done by coal. The chief obstacles to an early change on the larger roads are the hundreds of millions invested in locomotives, and the very large outlay required to equip existing steam roads with the electric system. The principal inducement would be the passenger service, owing to the increased speed possible, it being confidently stated that, with electricity, a speed considerably over one hundred miles per hour could be attained. Moreover, there would be entire abolition of the poisonous smoke which drops upon the Pullman in preference to any coach ahead of it.

While the conversion of trunk lines would be attended with a cost which is for the present prohibitory, this objection does not apply to new lines, which may be worked independently, or in connection with electric ones. When the time arrives for such railways, water power will have a field of usefulness of which we can at present form little conception. Water wheels and wires would displace the coal docks, the coal-laden vessels, the huge coal yards, and the trains required for distributing their contents over hundreds of miles of lines.

An interior line connecting Lake St. John, on the Saguenay, with Lake Temiscamingue, on the Ottawa, which could ultimately be extended, via Missanabei, Nepigon and Lac Seul to the Saskatchewan, would be a colonization road, removed from the frontier—one which could be worked possibly altogether by water power, and would open a virgin tract in which electro-chemical and electro-metallurgical industries might arise, as well as those connected with the products of the forests and the mine.

SPARKS.

The city of Winnipeg, Man., wants tenders by August 12th for the supply of twenty miles of wire for a fire alarm system.

The Hamilton Brass Works, of Hamilton, Ont., have followed the example of a number of other manufacturers in Hamilton and installed in their factory a 30 h.p. S. K. C. motor, which is operated by current from the Cataract Power Company's lines.

The Nelson Electric Tramway Co. have just closed a contract with the West Kootenay Power & Light Co. for the supply of power for the new street railway at Nelson, B. C. Mr. C. H. Hall has been appointed engineer-in-charge of the construction work.

The Dominion Coal Co., Cape Breton, N.S., are adopting electricity for the lighting of their mines, and have placed an order with the Canadian General Electric Co. for one of their standard 30 kilowatt direct connected generators, together with switchboards and wiring.

Prominent Montreal men have made application for a charter for the Wire & Cable Company. The capital is to be $500,000 and the factory will be located in Montreal. Messrs C. F. Sise, L.B. McFarlane and C. P. Sclater, of the Bell Telephone Co., are among the promoters.

The corporation of Fort William are setting up in their new power and pumping station a new 180 k.w. S. K. C. machine, with switchboard, etc. They are also largely increasing their incandescent lighting. When completed this will be one of the most up-to-date and modern electric light and water power systems in the Dominion.

The corporation of Dundalk, a short time ago, passed a by-law to raise $9,000 for the purchase of an electric lighting plant. The contract for the engines and boilers was awarded to E. Leonard & Sons, of London, and the contract for the electrical equipment, consisting of a 30 k.w. S. K. C. generator, with switchboard, transformers, etc., to the Royal Electric Company, of Montreal. The plant is to be in operation by Sept. 15th.

The town council of Arnprior, Ont., will likely enter into a contract with Robert Anderson, of Ottawa, for lighting the streets for five years. Mr. Anderson's proposition is to furnish twenty lamps of 1,200 candle power at the price of $42 per year, and to light the town hall with 16 candle power incandescent lamps at the cost of 1 cent per hour, 50 per cent. discount. The council have decided to take this step in view of their inability to obtain from the Arnprior Electric Light Company what was considered a reasonable price.

A most complete electric light plant has been installed by the British Columbia Marine Railway Company's ways at Esquimalt, B.C. This enables the company to dock or launch ships just as easily at night as in the day, and makes it possible to carry on work on vessels both night and day, causing a considerable saving to the owners. The plant, which was installed by Messrs G. C. Hinton & Co., consists of a 120 16-candle power light dynamo. Fifty lights have been placed on each side of the cradle, every other lamp being attached to a long insulated cord so that it can be placed wherever required. Five arc lights have been placed on the wharf and mounted on a carriage, so that they can be moved about the yard as a 6,000 candle power search-light. The light from this can be thrown across the harbor to guide ships to the railway, or when ships are on and work is proceeding at night, used to give additional light to the workmen. The company have awarded the contract to Messrs. Hinton & Co. to install a duplicate plant at the railway they are constructing at Vancouver.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

THE ANNUAL CONVENTION.

Arrangements are nearing completion for the annual convention of the above association, to be held in Berlin on Tuesday, Wednesday and Thursday, August 15th, 16th and 17th. The members of the local association are working earnestly to make the convention a success. Besides the usual business, papers will be presented by Mr. E. J. Phillip, of Toronto, and others, and on Thursday evening a banquet will be held at the Walper House, at which it is expected there will be a large number of guests.

From Mr. G. C. Mooring, of Toronto, who is acting executive-secretary, we learn that the reports from the various associations indicate that there will be a satisfactory attendance. The Toronto contingent, which will comprise probably fifteen members, is expected to leave at 8:30 a. m. on Tuesday. Delegates should buy a single ticket, and obtain from the secretary at Berlin, Mr. W. Oelschlager, a certificate stating that they were in attendance at the convention. This will entitle them to return fare at a reduced rate. Following is the programme :

OFFICIAL PROGRAMME.

TUESDAY, AUGUST 15TH.—11 a. m.—Reception of Delegates ; Mayor's Address of Welcome. 2 p. m.—Meeting of Committees.

WEDNESDAY, AUG. 16TH.—9 to 12 a. m.—General Business. 2 p. m.—Reading of Papers and Discussions. Evening.—Open Air Concert by B. M. S. Band in Victoria Park.

THURSDAY, AUGUST 17TH.—9 a. m.—Business of convention continued. 2 p. m.—Election of Officers and other Business. 9 p. m.—Banquet House at Walper to the Officers and Delegates.

TORONTO NO. 1.

At the annual meeting of Toronto No. 1, held on Wednesday, June 21st, the following were eleeted officers for the year : President, H. E. Terry ; vice-president, J. Huggett ; recording secretary, W. J. Webb ; financial secretary, A. E. Bourne ; treasurer, S. Thompson (acc.); conductor, J. Bannan ; doorkeeper, W. Butler ; trustees, W. Lewis, A. E. Edkins and W. J. Webb ; delegates to convention, A. E. Edkins, C. Moseley, J. W. Marr, W. J. Webb and J. G. Bain.

TORONTO NO. 18.

Toronto No. 18 have elected the following officers : President, J. M. Dixon, acclamation ; vice-president, T. Graham ; recording secretary, Jos. T. Smart, acclamation ; financial secretary, J. J. Richardson, acclamation ; treasurer, P. Trowern ; conductor, R. Riley ; door-keeper, James Hutchins ; trustees, A. W. Vancer, Joseph Hughes and F. W. Fanner ; delegates, Messrs. Dixon, Richardson and Trowern. A few questions relating to engine compounding, boiler construction and heating surface, and the comparative merits of fuel, were asked and satisfactorily answered.

HAMILTON NO. 2.

Hamilton association last month elected officers as follows : T. Chubb, president ; W. Sculthrope, vice-president ; J. Ironside, recording secretary ; J. Carroll, financial secretary ; W. Collins, conductor ; T. Carter, doorkeeper ; trustees, P. Stott, R. Pettigrew, R. Mackie ; auditors, G. Mackie, R. Pettigrew, W. Stevens ; delegates to convention, G. Mackie, J. Ironside.

Mr. Ernest S. Harrison has established business at 191 Thistle street, Winnipeg, Man., and will in future represent the Western Electric Company, of Chicago. He will give attention to electrical construction and repair work of all kinds, and will make a specialty of armature winding and motor repairs. He will also carry a complete stock of supplies.

Just as we go to press it is learned that the contract for the Ragged Rapid transmission scheme for the town of Orillia is likely to be awarded to Mr. P. H. Patriarche, of the Electric Maintenance & Construction Co., of Toronto. After a delay of several months, the contract was thrown up by the Central Construction Company, of Buffalo, the original contractors.

Mr. Ephrem Valiquette, of Montreal, was the winner of the gold medal at the Industrial and Mechanical course at the Monument National. Mr. Valiquette is provincial boiler inspector, president of the Engineers' and Mechanical Mutual Benefit Association, and also a member of the Canadian Association of Stationary Engineers. He is now foreman for Lymburner & Matthews, mechanical engineers, of Montreal,

ENGINEERING NOTES.

As to the causes of the round corners on the admission line of the diagram from the steam cylinder of his air compressor, a writer says that the diagram shows that the release opens late ; the compression is late, and therefore the admission is late, so there is no lead, thereby making the round corners referred to. All the movements are too late ; to overcome this, advance the sheave.

In a recent paper by Mr. T. Messenger before the Northeast Coast Institute of Engineers and Shipbuilders, a method of strengthing steam pipes was mentioned. It consisted in applying a series of clips (in two halves) cottered together, says the Practical Engineer. In a 12 inch pipe, with 100 pounds steam pressure, they have been pitched 6 inches apart. They have a sectional area 3/8 square inch (2 inches wide by 3-16 inch thick). One advantage that they undoubtedly offer is the restriction of a failure, as usually a rupture produces an opening extending from flange to flange. They can be easily applied to the joints or branch junctions, strengthening the necessarily weak places in a range of piping. We should think that there should be a large field for their use where brazed copper pipes are unavoidable.

Why should the pressure fluctuate more at the end of a long steam main than at the boilers ? is the question which is troubling one of the subscribers of Power. The answer given is that if there were no flow through the pipe the pressure at the far end would be the same as that at the boiler, and would vary as the pressure at the boiler varied. Steam will not flow from one point to another, however, without a difference in pressure, and the greater the rate of flow the greater the difference of pressure required. If the pressure at the boiler, then, were absolutely constant, there would still be a variation at the far end of the main dependent upon the rate of flow, and if the boiler pressure varied we should have at the end of the pipe a variation which would be the combined effect of the changing boiler pressure and the fluctuation due to the varying rate of flow.

FEED WATER.—Treatment of feed water by engineers has not, as a rule, met with any great success, as a number of experiences in this line that have been shown up will testify, but there a few tests that every one having charge of boilers should be familar with. The presence of hard or soft water is easily detected by dropping a few drops of alcohol that has dissolved all that it can possibly hold of good soft soap. The water will turn milky white if it is hard and remain clear if soft. Add to the water from five to ten drops of oxalate of ammonia in a test tube. If carbonate of lime be present the water will in a short time present a clouded or milky appearance, and in a few hours a precipitate will be found at the bottom of the tube. Take some of the feed water and add a few drops of nitrate of baryta or barium chloride. If sulphate of lime or sulphuric acid is present it wil be shown by a milky appearance, and by the formation of a white precipitate. If decomposed animal matter is the cause of all the trouble it will be shown by adding a drop of premaganate of potash, which will color the water a bright violet rose when first added. If decomposed organic matter is present the color changes to a dull yellow ; if present in large quantities, however, the color will in time disappear. If, upon adding a few drops of solution of prussiate of potash, a blue color is produced directly or after some time, it shows that iron is held in solution.

TO COVER IRON PULLEYS WITH LEATHER.—With a given tension of belt nearly three times as much power can be transmitted by a leather-covered pulley as with a smooth iron surface. It is a comparatively easy matter to cement leather to the face of a pulley so that it will stay for an indefinite length of time—in fact, until the latter is worn out or is forcibly torn from the pulley. It is an easy matter to make such a cement joint as it would be if cementing to wood or other porous substance. Any good glue can be used if suitably prepared and carefully spread on the iron surface. For such purposes a given amount of glue should be covered with an equal weight of water, aad the whole let stand for twenty-four hours until the water is completely absorbed by the glue. The mass should then be heated in a water bath until the glue is melted. This makes a concentrated glue solution. This is to be spread on the surface of the pulley after the leather has been suitably prepared. A strong solution of tannic acid should be used for moistening the leather before it is applied to the glued surface. The solution should be applied warm. The surface of the pulley should be roughened by cross-filing, or the use of acid before the glue is applied, and the glue should be warm when the application is made. The leather used for covering pulleys may be pieces of old belting or split leather. The size of the pulley can be increased considerably by the use of the leather covering.

ELECTRIC RAILWAY DEPARTMENT.

MECHANICAL TRACTION BY ELECTRICITY.*

By GRANVILLE C. CUNNINGHAM, M.I.C.E.

IN the installation of mechanical traction by electricity on tramway systems, the point to be considered is how this form of traction compares in cost of construction and working with that it displaces, and what are the conditions that make for a high or low cost of working. It will doubtless be admitted that unless such form of traction were financially superior to other forms it would not be adopted ; but it will be useful to inquire wherein this particular superiority lies, as this indicates the direction in which the skill and resource of the engineer should chiefly be turned. The cost of constructing and equipping an electric tramway system is very much greater than the cost of a horse system. The receipts per car-mile may not be much greater, and with the largely increased mileage run may possibly be even less ; therefore, unless the expenses per car-mile of the electric system are very much less than the expenses of the horse system, whence can be obtained the large additional net revenue required to pay interest and sinking fund on the greatly increased capital invested ? It is accordingly to this lowering of the cost of electrical working that the attention of the engineer should be chiefly directed, and the best results in this respect can be obtained only by care in construction.

In the first place, on what item in working cost may a saving be looked for ?

In the matter of wages of men on the car no saving can be effected ; two men would be needed on the electric as on the horse car, and the electric employees may even be expected to require higher wages. The maintenance of car-body—painting, repairs, etc.—would be practically the same in either case ; the maintenance of the electric equipment of the car is an addition to any expense of the horse system ; so also is the overhead wire and feeder system ; the maintenance of the track would be greater for the electric system, including therein the bonding. In all thesee items the cost in the total would be greater for the electric than for the horse system. There would be some advantage to the electric system in being able to run at a higher speed, thus distributing the wages of motormen and conductors over a larger mileage in a day and reducing the amount of that item per car-mile. But this is not a large amount and would not compensate for the increase in the other items mentioned.

The only item remaining to be considered is the power used in the service, and it in in this item also that the saving can be effected. For this reason the power house on an electric system is the point to which the intelligence and skill of the engineer should be mainly devoted. It is upon this that the financial success of the undertaking depends. If it is carelessly constructed, with engines, boilers and appliances that do not insure a low cost of working, then it is certain that but a small profit—and perhaps no profit at all—will be realized. It is certain that no great financial success will be secured. Everything that will reduce the cost of producing the electric current should be sought out and applied in the construction of the power house

The cost of horse traction—and by this is meant the cost of horse-keep, wages of grooms, shoeing, veterinary expenses, but exclusive of drivers' wages—may be taken as varying from 3½d. per car-mile in an easily-worked town such as Glasgow, to 5d. per car-mile in a hilly and more difficult town, such as Liverpool. This is the cost of horse traction arrived at from the working of fairly large systems showing 7,000,000 car-miles annually in Glasgow and over 4,000,000 in Liverpool. The cost of electric power for traction on the overhead trolley wire system should, with enonomical engines, boilers and heat-saving appliances, be under ½d. per car mile for an easily-worked level town, and for a more hilly town with steep gradients slightly over ½d. per car-mile. The cost here meant is the cost of all wages, fuel, water, oil, etc., in the power house, together with the cost of maintenance, repairs and up-keep of the plant. The cars driven by this power are those weighing about 6½ tons when empty and capable of seating 26 passengers inside. In order to insure this low cost of working every care must be taken in the power house. In choosing its site it should be placed close to a plentiful supply of water, where all that is requisite for condensing purposes may be had at a nominal charge, or merely for the cost of pumping. A river, canal, pond or the sea would afford what is needed. It should be conveniently situated for the supply of coal from railway line, canal or wharf, so as to save the charges of handling fuel. One shilling per ton saved in cartage would amount to a very considerable sum in a year in a large traction station.

But, needless to say, the most important matter is the type of engines, boilers and heat-savers to be used. The writer favors low-speed (70 revolutions) compound condensing engines, such as are built by numerous English firms, boilers of the Lancashire or Galloway type, with Green's economizers. A plant of this character was constructed and worked under the writer's charge on the Montreal Electric Street Railway, with the result that the cost of producing current was a little under one farthing per kilowatt-hour, and the cost per car-mile less than half-penny in the open months of the year, when coal could be obtained for 9s. per ton. The consumption of coal was 3.48 lbs. per kilowatt-hour, or 2.60 lbs. per e.h.p.-hour, and this was maintained during the months of working. The average for a whole year was only 2-75 lbs. per ehp.-hour. It is not pretended that this is a phenomenally low rate of consumption. On board many of the large ocean-going steamers as low as 1.50 lbs. of coal per h.p.-hour has been reached with triple expansion engines ; but the writer believes that few electrical power-houses have been able to show better results than those mentioned. Nor is the result to be attributed to a very large output ; precisely similar results can be obtained by using similar appliances on a smaller scale. In the Montreal house there were six 800-h.p. engines, and the daily output of current averaged 43,000 units. But the author has recently obtained similar results with a small cable plant on the Birmingham cable system. In 1897 this plant consisted of a pair of single cylinder engines running at 53 revolutions of 287 maximum h.p., with Galloway boilers, and no special heat-saving appliances. It was necessary to increase the engine-power to meet increased traffic. The author put in a pair of superposed compound condensing engines of 400 h.p. running at same speed as before, and obtained condensing water from a well in conjunction with a tank and cooling tower. The result was that the consumption of fuel was reduced from about 325 tons per month, or 8.9 lbs. per car-mile, to 6.5 lbs. per car-mile; and the introduction of Green's economizers has further reduced the consumption to 4.7 lbs. per car-mile, or to about 3 lbs. per h.p.-hour. On the Birmingham small cable system, the saving does not amount in money to a large sum, but on a great electric system running, say, 7,000,000 car-miles in the year, 4 lbs. of coal saved per car-mile, at 9s. per ton, amounts to £5,625 per annum ; and it is this consideration that gives emphasis to the plea for an economical power-house plant.

To return to the previous argument. Note what a large saving is effected when a cost of ½d. per car-mile for power is substituted for 5d.; on a car-mileage of 7,000,000 it means no less a sum than £131,250 per annum ! and indicates the source whence the increase of net earnings may be obtained to pay for the heavy cost of electrical installation. The whole cost of working a large electric system, including working charges of all kinds, should be under 5d. per car-mile ; but this can only be obtained with a carefully constructed power-house, where the works-cost of the current is cut down to a minimum.

The limits to which this note had to be confined prevent the introduction of any more elaborate figures or statistics than those given ; but enough has been said to indicate that, in the writer's judgment, it is to the power-house that the chief attention should be directed in order to ensure the financial success of an electric system. Other parts of the system claim attention, but it is on this that success or failure mainly turns. More money can be lost on the one item of power than would pay all the other working charges, and whether the high potential system with transformers or the multiple unit system be adopted, the successful working ultimately depends upon having engines and boilers that will do their work with a low consumption of fuel.

*Read at the Engineering Conference, Section VII, of the Institution of Civil Engineers, London, Eng., June 8, 1899.

It is believed that the council of the town of Woodstock, Ont., will accept the proposition made by Messrs. Ickes & Armstrong, of Harrisburg, Pa., for the construction of an electric railway in that town.

SPARKS.

Robert Surtees, C. E., of Ottawa, has estimated the cost of an electric light plant for the village of Shawville, Que., at $4,000.

The Canada Atlantic Railway Co. will this fall commence the erection of additional car works at Ottawa, to be operated by electricity.

The Hull Electric Co., at a meeting held last month, elected directors as follows: Alex Fraser, David McLaren, W. J. Conroy J. B. Fraser, R. H. Conroy and T. Viau.

Figures are being taken on developing the power of the Current river at Port Arthur. It is said that the work will cost about $5,000 and will include four turbines of 75 h.p. each.

Messrs. Corey & Campbell, of Bedford, Que., have given the United Electric Company, of Toronto, an order for one of their 1,000 light inductor alternators for street and commercial lighting.

Two buildings are being erected at Waverly, N. S., for the company which has been formed to manufacture electrical apparatus, fuses, etc. There will be five buildings in all, and the industry will employ a large number of hands.

The Dominion Electrical Works, Limited, has been formed at Halifax, N.S., for the purpose of manufacturing electrical apparatus and supplies. The capital stock is placed at $30,000. B. F. Pearson and Harold Covert, of Halifax, are among the promoters.

The new steamer "Argyle," plying between Kingston and Ontario Lake ports, is one of the palace steamers of Lake Ontario, its fittings being of the finest. It is lighted throughout by electricity and also has a search-light. The entire electrical plant was installed by the Royal Eiectric Co., of Montreal.

The Eastern Townships Electric Company, of North Hatley, Que., has been granted incorporation, with a capital stock of $300,000, to generate electricity and construct necessary works for the purpose. Andrew J. Gordon, of North Hatley, and F. E. Lovell, of Coaticook, Que., are members of the company.

Mr. Moise Paquin, of Maskinonge, one of the promoters of La Societe Industrielle du Comte de Maskinonge, is negotiating with American capitalists for the sale of St. Ursule Falls, on Maskinonge river, in the province of Quebec. It is said that these falls are equal to the Shawenegan Falls for power purposes. They have a decline of 180 feet and no less than seven cascades, at the foot of each of which industrial establishments could be erected on solid rock foundation.

Ottawa capitalists are said to be considering a scheme for the harnessing of the entire water power of the Chaudiere Falls. The idea is to build a large canal from near the head of the falls down through a suitable channel, the water to be directed into this by means of a dam, and a large power house to be built at the lower end of the artificial waterway. The electrical power thus developed would be employed for the running of saw mills, carbide factories, electric light plants, etc. It has been calculated that the falls would produce over 160,000 h.p.

The city council of St. Thomas, Ont., have renewed the contract for street lighting with the St. Thomas Gas Co. The company are to supply the same number of lamps as at present in use, all night, on a ten years' contract, at 25 cents per lamp per night, or 26 cents per lamp per night for moonlight schedule, with the provision that when the number of lamps reach 100 or more the price is to be reduced one cent per lamp per night. Incandescent lights for public buildings are to be supplied at 58-100 of a cent per lamp per hour.

It is announced that the company controlling the water power at Shawenegan Falls, Que., has induced the Pittsburg Reduction company to establish works there for the manufacture of aluminum. Aluminum, as is known, is extracted from a particular clay. Chome is to be found in quantities in Canada, and this, with a mixture of 94 per cent. of aluminum, will produce a metal said to be as strong as steel. If such works are established in Canada, it is probable that aluminum wire will be used to a greater extent for the transmission of electricity.

The City of Georgetown, British Guiana, has recently introduced the electric light. The arc lamps became centres of attraction to cockles, a species of small beetle, which swarm in myriads along the coast and river shores at the commencement of the Guiana rainy season, and each lamp was speedily filled to the brim. The front ranks of the insects then came in contact with the current, which set their bodies on fire. The immediate result was that the lamps were rendered useless for illuminating purposes, and vast clouds of intolerably noxious fumes emanated from them and floated into the neighbouring houses. the inmates of which were driven nearly frantic.

The Electric Light Co. which recently secured a contract for lighting the town of Merritton, and which have about 400 incandescent lamps installed in houses, and 20 enclosed arc lamps on the streets, have began operations with their own water power and apparatus. They have, however, made an arrangement now by which the St. Catharines Electric Light Co. are to furnish them current from their station, which is about four miles distant. The plant of the St. Catharines Electric Light & Power Co. is being considerably changed and enlarged. One side of their new 200 k.w. S.K.C. generator will supply the town of Merritton and that district lying south of their power house, and the other phase that portion of the city of St. Catharines north of their power house. During the hours of day-light this polyphase machine will be used for supplying power to the different industries in and about St. Catharines.

Rules for automobiles have been adopted in France to secure safety of passengers, pedestrians and other vehicles. These require that the operating mechanism, steering gear and brakes meet the approval of an inspection board, and are, in brief, that: Each vehicle must bear the maker's name, the type of the machine and the number of vehicle in that type, also the name and address of the owner. No one shall drive the automobile who is not the holder of a certificate of capacity from the Prefect of the department in which he resides. The driver of an automobile must always have the regulator of speed well in hand. In case of narrow or crowded thoroughfares, the speed must be reduced to a walking pace, and in no case must it exceed 18½ miles in the open country or 12½ miles an hour while passing houses. Racing is allowed, providing authorization is obtained from the Prefect and the mayors are notified. In racing speed of 18½ miles an hour may be exceeded in the open country, but in passing houses the maximum of 12½ miles must not be exceeded. The approach of an automobile must be signaled by means of a horn. Each automobile must be provided with two side lights, one white and the other green.

TRADE NOTES.

The Canadian General Electric Company are installing a 50 horse power three-phase induction motor at St. Elmo mine, Rossland, B.C., for the James Cooper Mfg. Co.

The McLaughlin Carriage Company, of Oshawa, have placed an order with the United Electric Company, Ltd., for a 25 k.w. direct connected generator and engine, with complete accessories for operating same.

The Canadian General Electric Co. have recently sold the Wm. Hamilton Mfg. Co., Vancouver, B.C., one of their standard compound wound multipolar generators for direct connection to Pelton water wheel.

The large 176 barrel mill of the Dowling Milling Company, at Edmonton, N.W.T., is being furnished throughout by the Goldie & McCulloch Company, Ltd., Galt, Ont. This includes engine and boiler, as well as mill machinery.

The corporation of Bothwell, Ont., have placed an order with the Canadian General Electric Company for all the additional material required for extending their plant recently installed by the Canadian General Electric Company.

The United Electric Company, Ltd., Toronto, have closed a contract with the Kingston Hosiery Company for a 30 h.p. direct connected generator, switchboard, engine, and the installation of lights throughout their mills at Kingston, Ont.

The Goldie & McCulloch Co., Ltd., Galt, Ont., have just completed the placement of two large cross compound Wheelock engines at Bond Lake, in the power house of the Metropolitan Street Railway Company. The engines are from 400 to 450 h.p. each.

The Robb Engineering Company, of Amherst, N. S., has recently received the following orders from British Columbia: City of Kamloops, a 150 h.p., and the Hastings Exploration Syndicate a 60 h.p. Mumford improved boiler; Hugh C. Baker, Rossland, a 15 h.p., and Robertson & Hackett, Vancouver, a 50 h.p. Robb-Armstrong engine.

Messrs. Steinhoff & Gordon, of Wallaceburg, who are erecting a stave and heading mill at Tweed, Ont., have decided to add an electric lighting plant to light the town of Tweed. The order for the electrical apparatus, consisting of a 40 k.w. S. K. C. generator, with switchboard and complement of transformers, has been given to the Royal Electric Company, of Montreal.

SPARKS.

The city council of Montreal is again taking steps to compel manufacturers to install smoke consuming apparatus.

The Standard Chemical Co. are installing a new electric plant at their works at Deseronto, Ont. The Canadian General Electric Company are supplying the apparatus.

The Montreal Street Railway Company have placed an order with the Canadian General Electric Company for 10 additional 2 motor equipments of their standard G. E. 1000 type.

Messrs. W. D. McNair, of New York, and J.S. Clark, of Ayr, are promoting an electric railway from Ayr to Berlin. They have made application to the council of North Dumfries for right of way.

A 40 h.p. S. K. C. induction motor has been installed by the Cataract Power Company in the works of the Hamilton Tack Co., which will add another smokeless chimney to the "Electric City."

Senator Proctor, of Vermont, who is interested in the proposed pulp and electrical works at Grand Falls, N.B., states that surveys have been made and that Montreal engineers are now at work on plans of mills, dams, canals etc.

The United Electric Company, Toronto, have received an order from the Kootenay Supply & Construction Company, of Nelson, B. C., for a 100 k.w. generator direct connected to Pelton water wheel, to operate under 360 feet of water head.

The ratepayers of Niagara Falls, Ont., have voted in favor of purchasing the plant of the Niagara Falls Electric Co., at the price of $71,000. It is proposed to utilize the power during the day time for operating the works of the Ontario Silver Plate Co.

The Dominion Government is calling for tenders, up to August 18th, for the supply of 330,000 pounds, or 165 tons of galvanized iron telegraph wire; also for delivery with above of 10,000 pounds of soft annealed galvanized iron tie wire. Particulars may be obtained from E. F. E. Roy, secretary Public Works Department.

The city of Hull Que., recently invited tenders for an electric light plant, but as yet the council has not awarded any contracts, on account of the pending law suit between the Ottawa and Hull electric companies. The city solicitor gives it as his opinion that the city has a right to establish its own plant, notwithstanding the privileges given to the electric companies.

The Gowans, Kent Co., of Toronto, have given a contract to the United Electric Company, Ltd., Toronto, to equip their new wholesale warehouses with a complete electric plant, consisting of 30 k.w. generator, direct connected to high speed engine, also boiler, switchboard, three elevator motors, and the installation of lights and fixtures throughout their five-story building and basement.

The recent introduction of series enclosed arc lighting from alternating current systems by the Canadian General Electric Company is meeting with the approval of all central station managers. The Sherbrooke Gas & Electric Co. was the first to adopt this system in Canada, and will shortly have their new installation completed. The Halifax Tramway Co. have just placed an order with the Canadian General Electric Company for 100 of these lamps, with transformers.

The city council of Winnipeg, Man., recently accepted the following tenders for supplies and apparatus in connection with the electric light plant: Electrical supplies, Canadian General Electric Co., $140.22; one 100 h.p. high speed engine, E. Leonard & Sons, London, $1,246; leather belting, Sadler & Haworth, Toronto, $4.90 per lineal foot for 42 inches in width, and $1.45 for 14 inches; shafting, pulleys, etc., Dodge Manufacturing Co., Toronto, $1,700. For wiring the city hall the tender of H. Rose was accepted, at $318.45.

On June 14th last judgment was given at Ottawa by Mr. Justice Burbidge in the patent case of the General Engineering Co., of Toronto, vs. The Dominion Cotton Mills Co. and the American Stoker Co. The plaintiffs claimed that the defendants had infringed their patent for improvements in furnaces, etc., by making and erecting for use, at the works of the Dominion Cotton Mills Co., furnaces with a system of fuel supply the same as that covered by the plaintiff's patent. Judge Burbidge upheld the validity of the patent and gave judgment for plaintiffs.

The contracts are said to have been let for the electrical machinery and water wheels for the calcium carbide works at Ottawa. The entire plant will cost about $225,000. The electrical apparatus will be supplied by the Canadian General Electric Company, of Toronto, and will consist of two single phase generators, directly connected to horizontal turbines, without gearing. There will also be two 400 h.p. 225 volt direct current machines for operating motors for crushing, mixing, etc. The switchboards will be grey marble, containing all the necessary instruments for controlling the heavy currents incidental to the operating of such large generating units. The current will be conveyed from the generators at a potential of 2,300 volts to the transformers, where it will be reduced to 75 volts for the furnaces.

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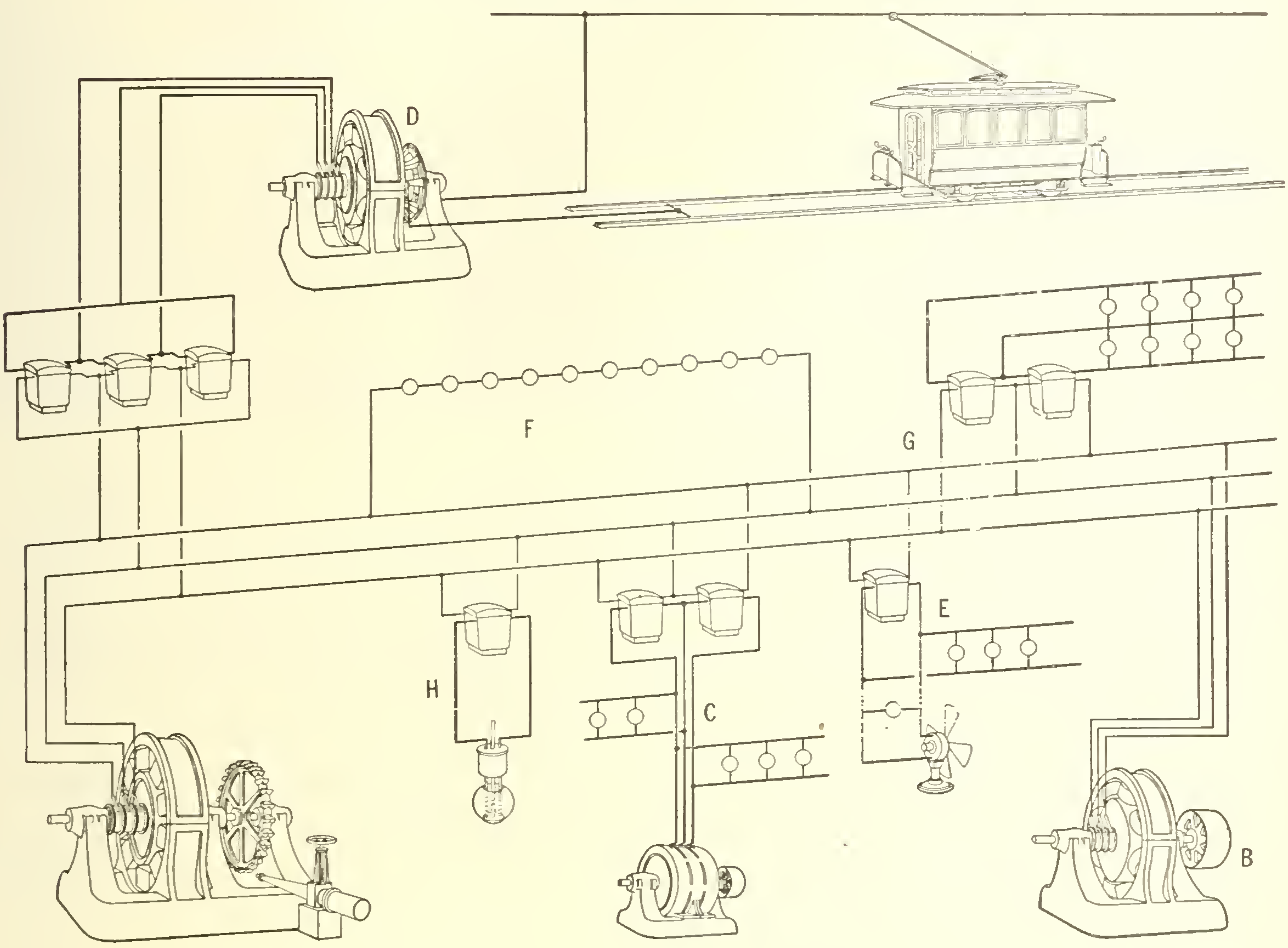

This Company was the first to introduce Long Distance Power Transmission in Canada, and as evidence of the superiority and success of the apparatus installed, we append a partial list of Power Transmission Plants in operation and under construction, contracted for during the past few years, viz:

Lachine Rapids Hydraulic & Land Company	Montreal, Que.	12,000 H.P.,	6 mile Transmission.
Montreal Cotton Co.	Valleyfield, Que.	4,000 "	Short "
St. Hyacinthe Electric Light Co.	St. Hyacinthe, Que.	500 "	4½ mile "
Department of Railways and Canals	Soulanges Canal	700 "	14 " "
Trenton Electric Co.	Trenton, Ont.	400 "	12 " "
Lunenburg Gas Co.	Lunenburg, N.S.	150 "	9 " "
J. R. Scott & Co.	Napanee, Ont.	150 "	8 " "
J. R. Booth, Esq.	Ottawa, Ont.	500 "	4 " "
Auburn Power Co.	Peterboro', Ont.	400 "	2½ " "
Hanover Electric Light and Power Co.	Hanover, Ont.	100 "	8 " "
Durham Electric Co.	Durham, Ont.	100 "	4 " "
Light, Heat and Power Co.	Lindsay, Ont.	600 "	14 " "
B. C. Electric Railways Co.	Vancouver, B.C.	1,600 "	12½ " "
West Kootenay Power Co.	Rossland, B.C.	4,000 "	39 " "

FOR INFORMATION ADDRESS NEAREST DISTRICT OFFICE

The Standard Light & Power Co., of Montreal, is building a new station on Chenneville street. For the necessary machinery to be installed therein, contracts have been let as follows: Rotary converters, Canadian General Electric Co., Toronto; Engines, Westinghouse Co., Pittsburg; boilers, Babcock & Wilcox Co.

Prof. L. A. Herdt, Lecturer in Electricity at McGill University, Montreal, has written a letter to the Board of Trade on the subject of lighting the channel of the St. Lawrence river, with a view to carrying on navigation at night. He proposes to place a projector or search light on the bow of every ship. This would cast light upon a double row of white buoys defining the channel. If the steamer had a dynamo on board, the matter would be more simple; if not, a compact storage battery would accompany the apparatus. The matter has been referred to the harbor engineer for a report.

CANADA'S GREATEST FAIR.

This year will mark the coming of age of Canada's Great Fair and Industrial Exposition, which will be held in Toronto from August 28th to Septemher 9th. It is just twenty-one years since Toronto Exhibition was established as an annual institution under the present management. During that time it has increased five-fold in every direction, and to-day can fairly lay claim to have assumed a national character. Last year upwards of 300,000 people attended, and this year such arrangements are being made as will warrant the expectation of a still larger attendance. Many entirely new features will be presented, while the exhibits, with an increased amount given in prizes (totalling $35,000), will undoubtedly crowd the six hundred thousand dollars' worth of buildings to their utmost. The usual brilliant military spectacles will be given, illustrating recent famous feats of arms on land and sea by both England and America, and arrangements have been made for an illustration of wireless telegraphy, wireless telephoning and the improved X rays. In short, the Exhibition will be more than ever up to date.

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SEPTEMBER, 1899

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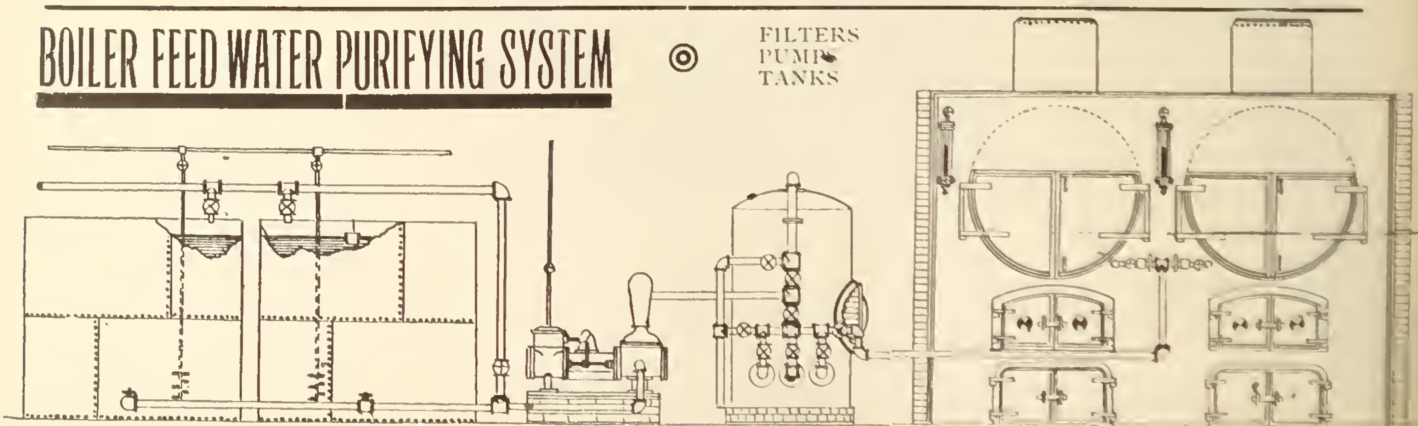

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CANADIAN
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Vol. IX. SEPTEMBER, 1899 No. 9.

THREE-PHASE POWER TRANSMISSION AT ST. HYACINTHE, QUEBEC.

By E. M. Archibald.

The oldest transmission plant in Canada employing a three-phase system is that in St. Hyacinthe, in the Province of Quebec, Canada, a city of 13,000 inhabi-

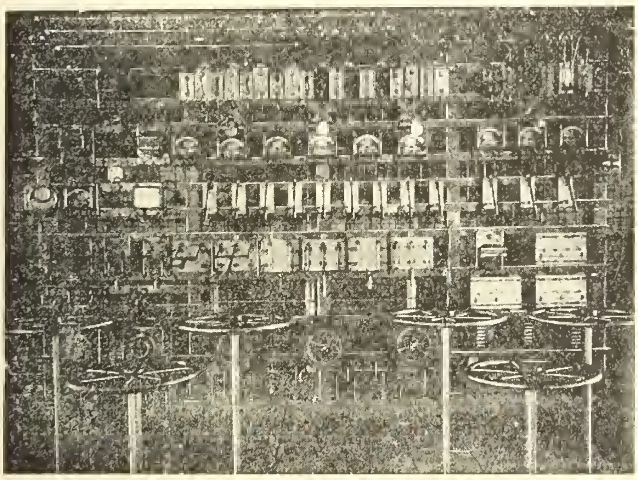

Fig. 1.—Switchboard.

tants, mostly French, distant about 40 miles from Montreal. In April, 1894, La Compagnie des Pouvoirs Hydraliques de St. Hyacinthe—or the St. Hyacinthe Hydraulic Power Co.—was formed, with the object of generating electrical power by utilizing the rapids on the Yamaska River and transmitting it into the city of St. Hyacinthe for illuminating and power purposes. By Christmas of the same year, the incandescent light had made its appearance there. This river Yamaska takes its source far back amongst the Green Mountains of Vermont, and its onward flow is fed by numerous small streams until it reaches the majestic St. Lawrence.

Situated five miles from the city of St. Hyacinthe, there was an old grist mill which had been operating for years by water power, a small head being obtained by damming up the river at Flat Rapid. This property the company secured and began improving the water power by raising the dam three feet, widening the head race from 15 to 40 feet, and by digging a tail race. The river at this point is 600 feet wide and one part of the dam has been built half way across, after which it turns slightly and runs obliquely towards the shore, thus making an entrance for the head race. This dam is of cribwork, in a triangular shape, filled in with cobblestones, 9 feet deep and 22 feet thick at the bottom. The up-stream side slopes upwards to the water surface and is 24 feet long, being the hypotenuse of a right angled triangle of the above dimensions. The timbers in its construction are all very large, those in front being 18 inches square. The side sloping upwards to the crest, 24 feet long, is lined with 3-inch planks 12 feet long, placed end to end, at the upper end of which iron plates ⅜-inch thick and 3 feet long are nailed in place across the whole length of the dam. These are used on account of the ice and rubbish which, passing over the crest, would otherwise injure it. This cribwork is also filled in with cobblestones.

In summer, when the water becomes scarce, planks 14 inches wide are placed edgewise on the crest of the dam to raise the head of the water by preventing any waste. The wing dam, extending from the beginning of the head race to the bottom of the tail race, a distance of 2000 feet, is also built of cribwork similar to the main dam, but is much higher and wider. The head race, originally 15 feet wide, is now increased to 40 and is 500 feet long, the sides being all boarded up. At the entrance a wooden boom 2 feet deep extends diagonally outwards, thus sweeping all ice and rubbish out towards the middle of the river and over the dam. A short distance further down four head gates, operated by a rack and pinion, control the supply of water entering the head race, while at the termination wooden racks prevent any rubbish which may have passed the boom from entering the wheel flumes. Four other wooden gates 6 inches thick are placed at the entrance of the wheel flumes, operated by gearing inside the power house. A waste gate at the termination of the head race allows of the disposal of all rubbish and dirt which may have entered.

The tail race, 40 feet wide and 1500 feet long, has been excavated from the solid rock by blasting. A head

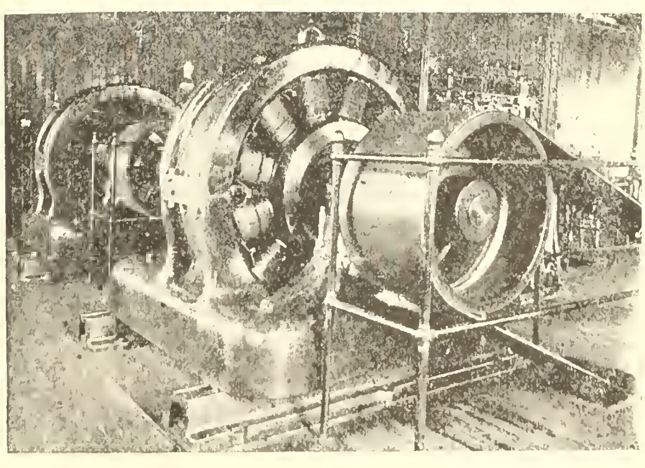

Fig. 2.—180 k.w. Three-Phase Generator.

of 16 feet has been obtained by thus increasing the height of the dam and by excavating a tail race.

The plan adopted for uninterrupted power is that of having a steam auxiliary plant, which may be used should the water become too low or should there be any trouble experienced with frazil and anchor ice. When

in small quantities the frazil is swept over the dam by the greater current there, but it cannot thus be disposed of when in great quantities, or on account of the frazil then tending to diminish the current from its very density. Anchor or ground ice is also encountered, this being the ice that forms on the rocks at the bottom. When this occurs the steam plant is put in operation

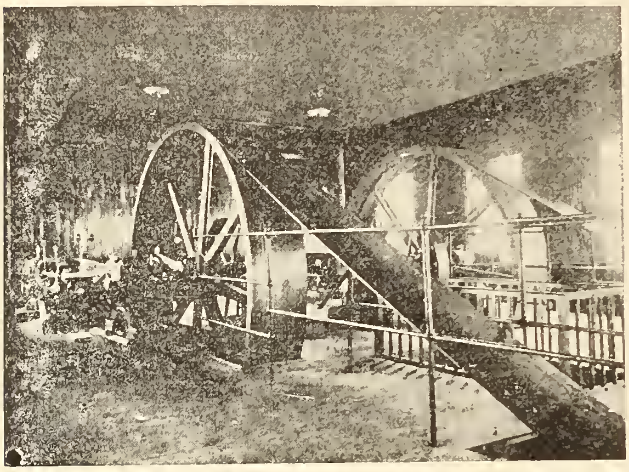

FIG. 3.—ENGINE ROOM.

until the morning's sun raises the temperature. Then the anchor ice rises immediately to the surface and is removed through the waste gate.

The power house is a wooden one-storey structure 150 feet long by 60 feet wide, extending from the outside of the head race on the wing dam to some distance on the shore. It is in three parts, the first situated on the head race being still a grist mill, not in operation, however, at present ; the second, the power house proper, containing the electrical apparatus, and lastly the steam plant. The cobblestone foundations are laid on the bed rock, 12 feet below the ground surface.

The hydraulic equipment consists of four 50-inch Samson wheels of the vertical type, each capable of developing 225-h.p. under a head of 16 feet, and running at 95 revs. per minute, manufactured and installed by James Leffel & Co., Springfield, Ohio. There are two water flumes, each containing two wheels. Power is transmitted from each wheel by means of a heavy bevel mortise gearing to a 5⅝-inch jack-shaft, running at 300 revs. per minute, under the floor of the power house and extending its total length. This jack-shaft is in four separate sections, so that any wheel may be closed down without interfering with the operation of the remainder. Each section is connected to its neighbor by a rigid coupling keyed to the shaft and yet movable to and fro on it by means of a lever.

When it becomes necessary to couple one section to that already running, water is gradually let into the wheel by opening its gates slowly, and as soon as the wheel attains the correct speed the coupling attached to its section of shaft is moved along by the lever until it engages with the opposite coupling and is then locked in position. The guide blades for each wheel controlling the quantity of water are connected together, all operating at the same time and controlled by means of a regulated wheel situated in front of the switchboard in the power house above.

Connected closely to the jack-shaft are three pulleys, each belt-connected to a generator on the floor above, which may be thrown into operation by means of three large Hill friction cluthes, each controlled by a wheel placed in front of the switchboard, by which it may be engaged or disengaged. Another pulley is placed on the jack-shaft belt-connected to a pump used for fire purposes only. The jack-shaft, with all the gearing, pulleys and friction clutches, were installed by Miller Bros. & Toms, of Montreal.

The electrical equipment consists of three 180-k.w. three-phase Canadian General Electric generators, "star" connected, each machine having 12 poles, running at 600 revs. per minute, and delivering current to the line at a pressure of 2500 volts and at a frequency of 60 cycles per second ; two 6-k.w. standard bipolar Edison exciters, each belt-connected to a generator, and each capable of fully exciting the fields of the three generators ; and a 4-pole, 5-k.w. Crompton exciter of the upright type, belt-connected to one of the generators and running at 1220 revs. per minute. The 18-inch oak tanned belt connecting each generator to its pulley on the jack-shaft below is guarded by a substantial iron railing. All the electrical apparatus, including the switchboard, but with the exception of the last mentioned exciter, was manufactured and installed by the Canadian General Electric Co., of Peterboro, Ont.

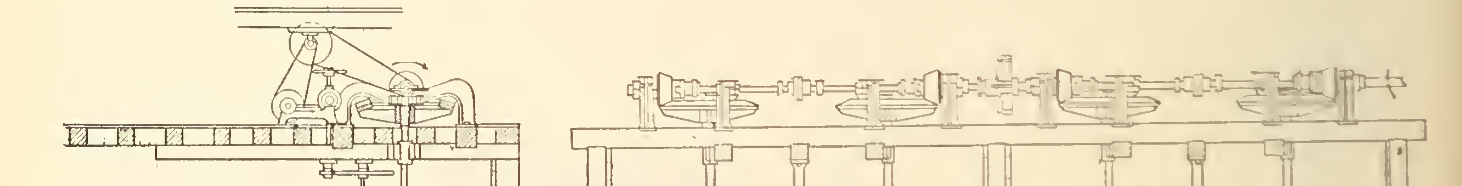

FIG. 4.—ELEVATION OF WATER-WHEELS.

The switchboard, as may be seen from Fig. 1, is a four-panel skeleton hardwood board. The first panel is the exciter, the second and third are the generator panels, while the fourth and last is the line panel. The

exciter panel contains the synchronizing apparatus, consisting of three step-down station transformers and the phasing lamps, coupling being performed when the lamps are bright, all on front of the board, besides the regulating apparatus for the three exciters. This consists of two ammeters, one voltmeter connected to any exciter by a switch, and two rows of switches for connecting any exciter to any generator field. Of these two rows the top line is made up of three double-pole double-throw switches to connect any of three exciters, their terminals being connected to the middle pole, to either of two generator fields. The lower row contains three double-pole single throw switches for exciting the remaining generator field from either of the three exciters. At the extreme bottom of the board are situated the three exciter rheostats.

The two middle panels contain the apparatus for the three three-phase machines. Nine duplex fuses are placed on the top of the board in front, connected in each of the three machine leads in such a manner that should one fuse blow, the other may be thrown in immediately by closing a single-pole switch placed below. Between the fuse blows and the fuse switches are 9 ammeters, one for each machine lead; then a row of six switches, alternately the generator field and the main switches, the former being double-pole and the latter triple-pole for the three phases. At the bottom of the board are the three enamel field rheostats. The last or line panel contains three duplex fuse blocks with the three accompanying single-pole switches, serving the same purpose as those on the machine panels already explained ; three ammeters, one for each line, and finally the ground detector, of the ordinary lamp type, and six lightning arresters, only three of which are in use, these being the Wurts non-arching type and having 6 gaps between each line and ground.

No choke coils are used whatever. From the last panel the wires pass directly to the line at a pressure of 2500 volts, no step-up transformers being used. Directly in front of the switchboard are two rows of regulating wheels, as may be seen in Fig. 1, the front row containing four, for purposes of regulating the quantity of water entering each wheel by suitably adjusting the guide blades. The back row consists of only three, each regulating the friction clutch on the jack-shaft for driving its generator.

It was found necessary to install a steam auxiliary plant to secure uninterrupted operation, on account of the scarcity of water in dry summers, and also on account of the frazil ice difficulty. This steam equipment consists of two 250 h.p. simple Corliss condensing engines, of the Jerome Wheelock type, running at 86 revs. per minute ; two 250 h.p. water tube boilers, both engines and boilers being manufactured and installed by the Goldie & McCulloch Co., Ltd., of Galt, Ont.; one $5\frac{1}{4} \times 3\frac{1}{2} \times 6$ inches feed pump for the boilers, water being taken from the head race, built by the Northey Manufacturing Co., Ltd., of Toronto, Ont., and a T. J. C. injector, used as an auxiliary feed. The boilers are situated in a brick building adjoining the upper end of the power house ; each engine is belt connected to a loose pulley on the jack-shaft, which, by means of a Hill friction clutch, transmits the power to the jack-shaft. All slack in the belt is taken up by a belt tightener situated on the power house floor at the point where the belt passes through to the jack-shaft below. Two 5-ton hand cranes are placed over the power house for handling and shifting machinery.

The three transmission wires coming from the power house pass to the pole line, which follows the highway into St. Hyacinthe, a distance of five miles. The voltage is 2500 direct from the generators, no transformers being used at either end except for the secondary distribution in the city. The wires are No. 00 medium drawn bare copper, securely fastened to the ordinary double petticoat glass insulators, and are placed on one cross arm, 18 inches apart. The poles are of white cedar, 40 feet long, 6 inches in diameter at the top, and are spaced 100 feet apart.

For protection against lightning a barbed wire is fastened with ordinary staples to the top of the poles and is grounded every fourth pole. In addition, lightning arresters of the Wurts outdoor type are placed at three points on the transmission line and also at two points in the city, each having an insulated wire running to ground on glass insulators. A telephone line connecting the power house and the company's office is placed on the same poles, but a distance of 7 feet below the transmission line. It is also frequently transposed to neutralize induction.

On the principal streets, four-wire secondary mains are run from banks of single phase transformers, reducing the primary voltage to 104. Power and light are both taken from the same circuits, but the drop due to the inductive load is not great, as the motors, although of the induction type, are neither large nor numerous. The largest is a 50 h.p. Oerlikon three-phase induction motor supplying power to a boot and shoe factory. The drop of voltage in the line, due to starting this motor, is too great to pass unheeded, so that a signal, by means of a magneto bell, is sent to the power house when the motor is to be started, and the machine voltage is regulated accordingly.

Current for light is sold by meter, the rate being 10 cents per k.w. hour. There are still a few flat rate customers, but they are gradually coming to use meters. Power is sold both by meter and by the flat rate, the charge in each case being according to the amount required.

The author desires to thank Mr. A. M. Morin, general manager of the St. Hyacinte Hydraulic Power Co., and Mr. Geo. Pominville, electrician, for assistance rendered in connection with the preparation of this article.—Electrical World.

We understand that the Cleveland Seed Co., of Picton, have placed their order with the Royal Electric Co. for a complete electric lighting plant for their warehouse. The dynamo is of 200 light capacity, and about 100 lights are wired up. The work is being done under the supervision of Mr. Crandall, of Picton.

A physician of Belleville, Ont., has received a letter from a participant in the Soudan campaign, which contains an account of a novel method adopted for the generation of electric current for use in Rontgen ray work in the field. "The pulley of a small dynamo," the writer states, "was connected by means of a leather strap with the back wheel of a specially constructed tandem bicycle. The required velocity for the dynamo was thus obtained and our procedure was as follows: Having carefully adjusted the circuit with the storage battery, and also with the voltmeter and ammeter, a warrant officer took his position on the seat of the bicycle and commenced pedaling. When 15 volts 14 amperes were registered, the switch, close to the handle of the bicycle, was opened and the charging of the battery commenced. As the resistance became greater, a sensation of riding uphill was experienced, and the services of an additional orderly were requisitioned for the front seat. The bicycle practice was generally carried out in a shade temperature of 110 deg. F., so that at the end of half an hour the orderlies were not sorry when the switch was turned off and the machine brought to a standstill."

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Interesting Experiments.

DR. Leopold Kann, of the United States Arctic Geological Survey, is arranging for an expedition to Ellesmere Land, west of Greenland, for the purpose of studying atmospheric electricity. Absence in that latitude of moisture in the atmosphere and of trees and other impeding substances, renders the conditions most favorable for the prosecution of such experiments. Dr. Kann hopes by means of electrometers now under construction to be able to make a series of accurate measurements of the electric currents in that latitude, and thus to demonstrate, if possible, the connection between atmospheric electricity and the rotation of the earth on its axis.

Electricity at the Fair.

ELECTRICITY is much in evidence at the Industrial Exhibition in Toronto. The experiments with wireless telegraphy and telephony and X rays conducted by Mr. W. J. Clarke, of New York, and the exhibit of electric carriages are prominent features, and have attracted much attention. For lighting and decorative purposes there are required in connection with this Exhibition 500 arc and 1,000 incandescent lamps—a plant requisite for the lighting of a medium size city. The majority of these lights must be newly installed each year to suit the constantly changing conditions. The larger proportion of these lamps are employed for signs and to light side-shows and refreshment booths, the location and requirements of which cannot be ascertained until the opening day, when there is an immediate demand from the lesees upon the Toronto Electric Light Co. for the installation of the necessary lamps. It will be seen that the task which is thus suddenly imposed upon the company is a most difficult one, and it is indeed surprising that work done under these disadvantages should have given such satisfactory results.

Horseless Vehicles.

THERE seems little room to doubt that in the near future horseless vehicles will be employed to a considerable extent commercially and for pleasure. It is estimated that in Europe there are at present in use 10,000 such vehicles. Over half this number are in France, where the development in this line has been the most active. In the United States the number is believed to be less than 500, but is increasing rapidly. In view of the possibilities in this new field, great interest attaches to the question—what motive power is best adapted for the propulsion of these vehicles? From statistics recently published, it appears that in France, where, as has been stated, the greatest amount of experimenting has been done, oil and gas motors are in greatest use. The experience of persons who have carefully studied the problem in Canada indicates that no class of motor which has yet been tried is best adapted to meet the requirements of all the varying kinds of service. The electrically propelled vehicle will probably best meet the requirements for pleasure in cities with well paved streets, but for country roads and the heavier class of delivery service the steam wagon appears to be the coming thing. Prof. Elihu Thomson has recently invented a steam boiler for this purpose which is said to be very satisfactory. A steam propelled vehicle, manufactured at Newton, Mass., has recently been purchased by Mr. Wilson Phillips, of Toronto, and will shortly make its appearance on the streets of that city. The claims made for

on its behalf are that it weighs less that 400 pounds, the boiler is tested up to 1,000 pounds per square inch, it can carry a supply of fuel sufficient to propel it one hundred miles, and can be operated at a speed varying from that of the slowest truck to 40 miles an hour, at a cost not exceeding three cents per passenger for a distance of twenty miles.

The Record of Acetylene.

In our July number was published as a part of the proceedings of the Convention of the Canadian Electrical Association, a tabulated statement, showing the number of acetylene gas plants installed and the degree of success which had attended their operation. In another column will be found a letter from a manufacturer of acetylene apparatus declaring the data given in the above mentioned statements to be entirely inaccurate. The Canadian Manufacturer also expresses doubt as to the accuracy of the published data, and calls upon the Electrical News to explain why it should have published what it could not prove to be true. A little investigation would have shown the editor of The Manufacturer that the data was compiled, as stated in print, from reports submitted to the Canadian Electrical Association, and was, as already stated, presented to the members by the President at the recent annual convention. Its subsequent publication as part of the proceedings followed as a matter of course. Under these circumstances the Electrical News is under no obligation to prove the correctness or otherwise of the figures. On the other hand, The Manufacturer has not published any evidence to support its contention that the data is unreliable.

Technical Education.

Not so many years ago Germany was little more than an agricultural country. That she should not always remain so, an expert was sent by the government to the United States to report in what way, if possible, her commercial position could be improved, and whether she compared favorably with other countries. This expert reported that in manufacturing Germany was being outclassed by other countries. The result was that immediate steps were taken to assist the manufacturing development of the country. This was done by means of the establishment of technical schools, in which a system of technical and commercial education was taught. In a very few years the benefit of such schools was to be seen in the increase and improvement of manufacturing industries, and in the extension of the foreign trade of the country, To-day Germany occupies an almost unparalleled position among the manufacturing countries of the world. For this her technical schools are largely responsible. The above facts give additional interest to a report prepared by a special committee of the Toronto Board of Trade on the subject of technical education. This committee, after reviewing the advantages of and necessity for technical training, makes the following remmendation : "That technical education, in order to be thoroughly successful, should be a part of the foundation of our general educational system, and elementary technology should be as speedily introduced into all forms of the public schools in the province as time and circumstances will permit. The technical subjects taught must vary according to the special locality, with due regard to the manufacturing industries to be benefitted." A list is also given of the subjects to be taught, which includes seventeen chief subjects in the technical department and thirteen in the commercial department, with a number of subordinate branches in each. Reference is made to the advantages of combining a commercial and technical or industrial education. In no other country in the world does greater necessity exist for the special training of the people than in Canada, with her abundance of natural resources awaiting development and the skilled hand of the artizan. Legislation now exists in Ontario empowering the introduction into our school system of a limited degree of technical training, but this does not seem to be sufficient, and we hope the time is near at hand when some more effective plan will be adopted. The Toronto Technical School was established mainly through the efforts of the Canadian Association of Stationary Engineers, who secured a government grant of $2,000 for the purpose. The attendance and the work accomplished at this school is evidence that there is a demand for such training as is there given. We believe many more persons would avail themselves of the advantages offered if they were better acquainted with the curriculum of the school.

Consolidation.

One of the most important events in the history of electrical development in Canada took place a week ago, when the control of the Hamilton Street Railway, the Hamilton and Dundas Railway and the Hamilton Radial Railway passed into the hands of the Cataract Power Company. It is understood that an attempt was made to include in this deal the Hamilton, Grimsby and Beamsville Electric Railway, but owing to the high price put upon the stock it was unsuccessful. The Cataract Power Company are seeking to provide a profitable market for the product of their electric generating station at DeCew Falls, which has a present capacity of 4,000 h.p. and an ultimate capacity of at least double that amount. With this object in view the company are understood to have under consideration the construction of radial electric railway lines to Guelph, Niagara Falls and other points. The city council recently gave them a ten years contract for public lighting, and they have also contracts for the supply of power to many of the leading industrial establishments in Hamilton. The capital of the Cataract Power Company has of late been very largely increased. It seems probable that in other localities where large water powers are available for the generation of current consolidation of electrical interests will take place, similar to that just consummated at Hamilton, but care should be taken that the capital stock is not placed too high.

The demand from Austria Hungary for electrical machinery is steadily increasing. The imports in this line from the United States last year were valued at $40,000.

The originality and artistic taste of Mr. F. B. Utley, advertising manager for the Goldie & McCulloch Co., of Galt, is responsible for the production of some of the neatest and most attractive booklets which have yet reached our desk. That worthy of special mention is a miniature catalogue in bronze and blue black of the "Model" gas and gasoline engine manufactured by the above company. The art here introduced gives the booklet a greater interest than would otherwise be obtained. Accompanying each cut of the "Model" engine is an illustration, for the purpose of comparison, showing the pioneer methods employed, such as hand and horse power, wind mills, etc. The small catalogues of bankers' safes and "Wolf" gyrator are also well designed and replete with new ideas.

ELECTRIC TRANSMISSION PLANT IN NOVA SCOTIA.

Mr. E. L. Nash,
Manager Luuenburg Gas Co.

The Lunenburg Gas Company, Limited, of Lunenburg, Nova Scotia, have recently installed a three-phase long distance transmission plant, to take the place of their direct current steam plant. The new power house is on the Mush-Mush river, one mile from the village of Mahone and eight miles from the town of Lunenburg. The Mush-Mush river is the best of its size in Nova Scotia for power purposes, it having at its head waters five lakes, with a united area of about twelve square miles, the outlets of which are controlled by the company. The dam, sixteen feet high, built of stone and timber, on a ledge of rocks that crosses the river at this point, is perfectly tight, and is one of the best constructed in the province.

The power house is 28 x 36 feet, two stories high, and is a substantial wooden building, with a metal roof. The water wheel is a "New Success" horizontal turbine, thirty-nine inches in diameter, of 165 h.p., built by the S. Morgan Smith Co., of York, Pa. It is so placed in a 12-foot penstock as to make it impossible for it to freeze up in winter. A twenty-four inch endless rubber belt conveys the power to a counter shaft ; thence a two-ply endless leather belt transmits it to the generator.

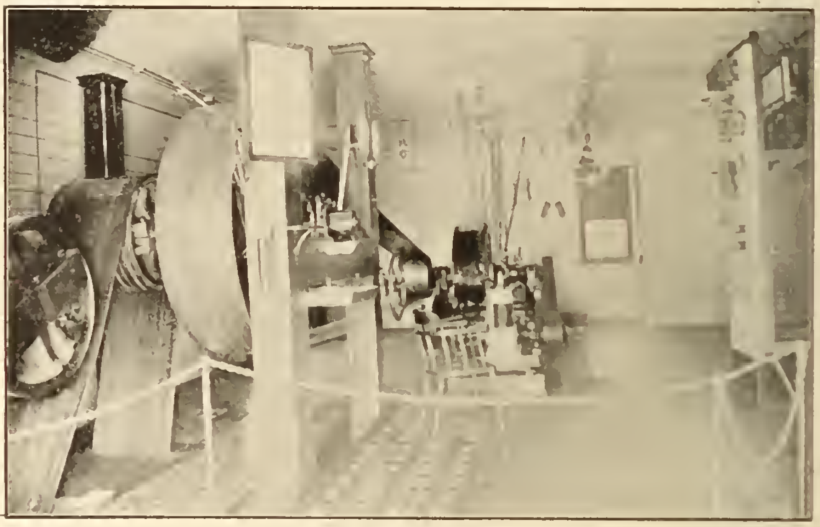
The generator was built by the Canadian General Electric Co., and is one of their standard 100 k.w. three phase machines, running at 900 revolutions and delivering a 3,200 volt current. The switchboard carrying the necessary station instruments was built also by the Canadian General Electric Company, and is a beautiful piece of apparatus. The wiring of the station is very neatly done. From the station the three-wire pole line runs straight across fields to the main street of Mahone. One large transformer in the middle of the village reduces the current to 104 volts, and a heavy three wire system distributes it to customers.

Power Station—Lunenburg Gas Company.

From Mahone the pole line runs along an old road to Lunenburg. This, like many another old road, is remarkably straight and hilly, enabling the company to have a first-class line. In the town of Lunenburg the old three-wire distribution has been divided into three sections, A B C. B and C have two transformers each, while A has one, the transformer at Mahone making the balance on that phase. The distribution is much better than with the previous system, and as the high voltage current passes along only one back street of the town, the plan gives great satisfaction.

The company have their own telephone line, with Bell instruments at Lunenburg, Mahone, and in the power house.

The pole line was built under contract by Mr. L. C Gelling, of Bridgewater. The water power portion of the plant was planned and constructed by Mr. T. G. Nicol, of Mahone, and the electrical portion by Mr. E. L. Nash, the managing director.



Interior View of Power House—Lunenburg Gas Company.

The present directors of the Lunenburg Gas Company are: W. N. Zwicker, president; Chas. S. Marsh, vice-president ; L. Joseph Rudolf, A. J. Wolffe, Jas. A. Nirtle, Lunenburg ; T. G. Nicol, of Mahone ; with Mr. E. L. Nash secretary-treasurer and manager. The company have over twelve hundred lamps running, and more are being added every week. The plant is already a financial success.

A novel method of testing the efficiency of coverings for steam pipes electrically is in use. A section of the steam pipe is heated electrically by means of a coil of wire within the pipe. The amount of energy necessary to keep the pipe at a definite temperature is measured. Since the energy supplied is just enough to maintain a constant temperature, it must therefore equal the heat lost from the pipe. Hence, from the electrical energy supplied the heat lost from the outside can be calculated. The new method, which was recently described by Prof. Chas. L. Morton before one of the American learned societies, would seem to be worthy of attention.

ELECTRIC TRANSMISSION AND ELECTRIC DRILLS FOR MINES.*

By F. Hille, M.E., Port Arthur, Ont.

When we see that in the neighborhood of a number of our mines the fuel supply for motive power is, or is nearing to become, a question of grave concern, and that this is heightened through the burning off of valuable timber by careless and unwise men, or through accidental igniting of the dry bush by the sparks of the locomotives, or even through lightning in the course of thunder-storms, then we are very vividly reminded to look for another medium that can drive the machinery and apparatus in our mines. Now, what can impress itself more quickly on us than the numerous falls of our creeks and rivers, whose roaring and thundering has become to many of us, who roved around this country so often, a familiar music, and which has lulled us many a bright night into the arms of Morpheus. How often has that little dream-god shown us these wild rushing waters harnessed into useful occupations, and how long will it be ere these dreams materialize and we shall have every one of these at present useless spending powers utilized for the benefit of one or another of our industries? But before I proceed with this subject I take this opportunity of warning our people of this vandalic destruction of the forest by fire, or we shall experience the consequence, that in a few years most of the little creeks and rivers, and with them the lakes small and large, will dry up, and we will be deprived of the present very convenient way of travel, and the cheap medium for power. One who has known this country for years has seen, with regret, the diminishing and disappearing of many of our water courses. Even Lake Superior is lower by nearly twenty-four inches since I first knew it, and this is principally caused by the burning off of the forest.

I mentioned above that we have numerous falls in our country from which we could derive motive power, and I do not exaggerate when I say that I know of nearly a hundred in the districts of Rainy River and Thunder Bay, some of considerable size and beauty. Many of them are right in our gold mining region, others in close proximity, and others again further off, but many so conveniently situated that they would not cause a great outlay of capital in transmitting the electricity profitably to the mines. We all know that distance is nowadays no great obstacle since improved machines and a better insulation are at our disposal. Even as early as 1891, at the time of the Frankfurt electric exhibition, the first long-distance power transmission of 110 miles in length proved a success, for the loss was only 26 per cent., although different pressures from 65 to 28,000 volts were tried; and now we talk of distances of 500 miles and losses of only 10 to 15 per cent. Distance has to be considered only, then, when the consumption of power in a mine is small and it is within easy reach of cheap communication. The question will arise, then, if it would not be more economical and convenient to use a different motive power, produced either with gasoline, or better yet, refined or crude petroleum, for instance with a Diesel motor.

The advantages of long-distance transmissions are specially noticeable when high voltages are transmitted for large industrial centres, or for the distribution of power among a greater number of mines, situated in close proximity, or for a mine far off from the sources of fuel. But, as I said above, it is very questionable if it will be always advantageous for a single mine to go to the great expense of establishing water power and transmitting it from afar to the workings. This has to be determined in every instance by closely figuring all the different conditions. We have, therefore, to consider transmission for greater distances, and such for electricity generated at the time.

Now let us suppose, for instance, that we needed a large amount of h.p. for different machines, and wish to sell our surplus power to others, and know we can get this power from a rather distant waterfall. We take also for granted that utilization of this fall and the establishing of the primary motor—here the turbine or any other water wheel—causes no difficulty whatever; therefore, the next thing to be taken into account would be the dynamo, that is, has it to be a direct current or an alternating current machine? Now we know we need a greater number of h.p., the distance is not inconsiderable, and we wish the current to do different work. In this case the only acceptable machine for us would be the alternating dynamo, because the direct current machine has a limited transmission of only about 2,000 volts, and this current cannot be divided in the manner we wish. This is different with the polyphase current, which can easily be transformed into direct current of any strength which we might desire, or charged into as many motors as its pressure will permit. I come now to the second question: the production of electricity by some other medium than water and directly at the mine. The building of dams, the paying of pipes, and the erecting of a power-house with all its machinery and other installations near a waterfall for the transmission of electricity over a long costly wire, is rather an expensive thing, and not every owner is in the fortunate position to indulge in such expensive enterprises. We conclude, therefore, to buy a Diesel petro'eum motor, which offers the most convenient and economic way to solve that problem. Also in this case the dynamo is a polyphase current machine, is coupled directly to the primary motor, and the generated electricity transmitted to the transformer and thence to the electric motors driving the various machines.

This mode of generating electricity will prove in many instances more advantageous and economic than the first system, for what we spend more in petroleum to run the motor we save again in wages for attending to the different machines and line of wire, and also on interest of capital expended, and not less so on loss of time in repairing, in telephoning from the mine to the power house at the falls, and I have a right to mention it, a saving of power in the shorter transmission. These are considerations of much importance, which will, I have no doubt, decide in many instances the choice between the two systems of primary power, especially in places where railroad or water communications are near at hand and the freights reasonable.

A mine which is in the fortunate position of having electricity as motive power should make use of its advantage and drive with electric motors everyone of its machines or works. The great convenience which accrues out of such an installation is obvious when we consider the difficulty which we experience often in transmitting the power of the steam boilers and engines, be it steam, air, or rope transmission, to our various mine workings. I might mention, however, that machines which need more than 50 horse-power would be better driven by a generator of their own, because the switching in and out of large motors would cause inconvenient

* Paper read before the Canadian Mining Institute.

differences of pressure in the main line, and would affect the other motors to some extent. What advantage it is, but especially in large works, to disconnect or switch out any machine or apparatus at any moment without being obliged to shift belts over loose or friction pulleys, nor being able to stop the humming and buzzing noise of the overhead shafting with its tangle of belts, which are a constant menace to everyone's dear existence, not to speak of the great convenience to convey the power with ease from place to place and from any machine above or below ground to another!

Now, I wish to direct your attention to one of these machines which has, strange to say, found in this country very little or no attention, although it deserves it very fully. It is this, an electric drill of a very ingenious but simple construction and of great efficiency. The reason that we have heard and read but little of it in this country, and even in the States, is that we are too indifferent in acquainting ourselves with what other nations do in the various industries, and this is especially the case in the mining industry. We patronise in many cases the home industry too much to the disadvantage of our miners and mines. To some extent it might also be attributed to the prejudice which seems to exist against electric drills on account of the poor success which the so-called Solenoid machines of Van Depoele and Marvin had. These machines were constructed after Werner Von Siemen's so-called electric hammer principle, but soon abandoned by the latter. The principal fault of these machines were their inefficiency and weak return pull of the bit, although the consumption of energy was large, too large compared with the newer drills of Siemens & Halske. But even that earlier machine is surpassed in waste of power by the air drills so much in vogue at the present time. These earlier machines had the Solenoids—the motor—in the drill itself, which was a great disadvantage, considering the shocks which they received with every stroke of the piston; besides, it became soon hot, and lost on account of this a large amount of energy, that is, efficiency. Different is it with the newer percussion drill of Siemens & Halske. The motor is here separated from the drill, and is connected with it by a flexible shaft of about 8 ft. long. This arrangement enabled the inventors to construct a more compact solid machine, but at the same time a more simple mechanism. The axis of the piston could be placed near the one with which it is fastened to the upright or tripod, therefore a more rigid position was secured, and a shaking when in operation was avoided. But to give the drill a still more steady working a fly-wheel was fastened on the crank shaft of the machine, whose inertia would hinder the power-transmitting mechanism, especially the teeth of the cog-wheels, from clattering upon each other. Another good arrangement is connected with the machine—the piston rod for the drill steel is hollow throughout, therefore it is not necessary to change the position of the machine when a new bit has to be inserted. It can be done from the hind end by releasing the key with which it is fastened in its place. Further, the feed of the steel is on these machines either by hand or automatic, but always self-regulating according to the hardness of the material to be drilled. A jamming of the bit in the hole, which is with most percussion drills a very common occurrence, happens very rarely, for the return pull of the piston is so strong that on account of this and the powerful concussion the columns or stretcher bars had to be constructed especially strong, and instead of the common tripod, a quatripod, if you will permit me to give the four-legged stand that name, had to be provided for this percussion drill.

In regard to the consumption of power, this machine excels in economy every other percussion drill so far invented or in the market. A drill working with full capacity will use from 0.8 to 1.3 kilowatt, or six drills in operation will need ten horse power of a steam or water engine, if the length of the transmission of power is not too great, and 12 horse-power if it is great. It will drill a hole in the hardest rock from 1¼ to 1½ inch wide, and from 2 ins. to 12 ins. deep in one minute; for instance, in very hard granite 3 ins. to 4 ins. deep per minute. There is not one percussion drill, steam or air driven, which could show such results combined with such economy. To make a comparison, only the largest size of air drill might be able to drill a hole of the same depth and in the same time above mentioned, but would need six to eight times the power of one of the smaller electric drills. The vertical depth drilled with this machine is 6½ feet, and the depth bored without changing bits is 16 ins., with abont 420 strokes per minute. The weight of the machine is about 240 pounds, and to raise and lower it on the stretcher bars with ease a small block and tackle is used.

Besides the percussion drill the firm of Siemens & Halske manufacture also a "rotary drill." This machine, which is used for boring in rocks and fossils of a softer nature, is of simpler construction and lighter weight than the former. No fly-wheel is necessary for this drill, because the drill barrel has only to follow the rotation of the flexible shaft and the forward feed of the inner mechanism, which is automatic and self-regulating according to the hardness of the material to be drilled. The consumption of energy is with this machine as with the former, about 806 watt = to one h.p., and will bore in rock salt a hole 1 6-10 in. wide by 12 to 16 in. deep, or in salt, clay, gypsum, or oolitic iron ore, etc., 8 to 10 in. per minute. With two bit changes the machine can bore a hole of over 6 ft. Its weight is not more than 70 lbs., and breakage or parts showing wear and tear can be easily and quickly replaced by new ones. The construction of the stretcher bar or column can be said to be a very handy apparatus.

I have to say now a few words about the flexible shaft which connects the drill with the motor. This shaft consists of two parts; the outer protecting flexible tube is made of a steel wire spiral and surrounded with leather, while the inner, the real power transmitting part, is a very pliable apparatus made of a number of right and left wound conaxial steel wire spirals, provided on both ends with massive steel pins and couplings, with which they rest smoothly against the outer protecting tube, and connect firmly with the motor and machine. The whole shaft is very solidly made, so that a rough handling in the workings will not injure it very easily.

Now, when we consider with what ease all the different parts connected with these drills can be carried from place to place, and compare it with the work that is necessary and the difficulty which exists in carrying the air or steam along in a mine, we understand readily the saving of time, and also the saving of expenses especially when we compare the much greater efficiency of these electric drills with those of steam or air.

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

ANNUAL CONVENTION AT BERLIN.

THE tenth annual convention of the Canadian Association of Stationary Engineers has passed into history. It was held on August 15th, 16th and 17th, in the C.O.F. hall at Berlin, one of the most progressive manufacturing towns in Ontario, where there is an active association of engineers with a good quota of members.

MEMBERS OF THE BERLIN AND WATERLOO ASSOCIATIONS.

When the convention opened at 11.30 a.m. on Wednesday, President W. G. Chapman, of Brockville, presided, being supported by the following executive officers: R. C. Pettigrew, Hamilton, vice-president; G. C. Mooring, Toronto, acting secretary and treasurer; W. Bear, Dresden, conductor; J. Wendell, Waterloo, door-keeper. The other delegates and members present during the convention were as follows:

Toronto No. 1—A. E. Edkins, A. M. Wickens, J. J. Bain, J. W. Marr, Chas. Moseley and W. G. Webb.

Hamilton No. 2—Joseph Ironsides.

Guelph No. 6—R. W. Greene.

Dresden No. 8—W. F. Jamieson.

Berlin No. 9—G. Steinmetz, W. Oelschlager, A. McKersie, J. Heyd, W. Tiedt, J. Koehler, B. Englert, A. Arndt, L. Bowman, C. Fries, K. Gildner, R. Cossey, F. Hisse, J. Schneider and W. Wilschonke.

Brockville No. 15—F. W. Turkington.

Waterloo No. 17—Nathan Uttley, F. A. Pflug, J. R. Uttley, N. Beam, F. Alward, W. C. Mielke, G. Beam, A. Stockfish, J. Nihill and M. Cadwell.

Toronto No. 18—J. M. Dixon.

There was also present Mr. T. J. Halsey, representing the Fairbanks Company, engineers' supplies, Montreal.

Mr. W. Oelschlager, chairman of the local committee, read an address, in which he extended to the delegates a hearty welcome to Berlin. President Chapman replied as follows:

PRESIDENT'S ADDRESS.

BRETHREN,—I have the honor to welcome you to this our tenth annual convention. I am aware that in selecting you as delegates our various branches have sent their best men. Consequently, I am confident that your deliberations will result in the advancement of our organization, and that in dealing with the various subjects brought before you, the one and only aim sought shall be the greater good of the C.A.S.E. I am sure that naught but good will shall prevail; indeed, such is one of the cardinal principles of our order. I need not ask for your hearty support, as this has always been given to the occupant of the chair. We have not increased the membership during the past year, only one new association was organized, and very few new members added to replace those who have withdrawn and those taken by death. But, brethren, I have the pleasure of saying that we have received into the C.A.S.E., out in Calgary, a lot of energetic members that in the near future will have their subordinate lodge second to none in our fair Dominion. I have also in my possession a letter from Bro. Wm. Cross, also one from a Mr. Cook, chairman of a committee appointed by the engineers out at Rossland, asking information as to the starting of an association in that place. So you see if we have lost in the east we have gained in the west, where everything grows in abundance and to an enormous size.

You will be asked to look over a bill drafted by a committee appointed by the Ontario Association, also to give your opinion and co-operation, that a greater effort may be put forth to have the bill become law at the next meeting of the local House. In this connection I should say that in this movement not only are the two associations a unit in favor of such a law, but, I might add, almost all the qualified engineers of this country are with us, as well as most of the steam users. It may be necessary at the present convention to again take up the matter of biennial conventions, with a view to the curtailment of the expense necessary for an annual meeting. Steps should also be taken to arouse the engineers of the Dominion to the loss they sustain in not being of our membership. I regret very much the steps taken by our secretary, also by Montreal No. 1. I presume most of you have seen the item in the Canadian Engineer that Montreal had moved to withdraw from the executive. For what reason? Because they did not get from the executive the results desired in accordan e to what they pay in; also that the cost of attending the convention was too great. Now, brethren, do you think that is the object? They have had for the past two years the executive secretary, a man possessed of good ability, and I consider it the most important office in the executive. So if they have not obtained what they want in the way of information it is their own fault. I think it would be wise to appoint some good past president to the secretaryship and keep him for a term of years, and have him devise some scheme whereby the subordinate associations will be drawn in closer touch with the executive head. For instance, he might send out problems to the different lodges, for them to work out and return, and any errors they might make could be rectified by him, thereby keeping up a correspondence and making the executive head a medium of instruction. These are a few points I have brought up for your consideration, and I feel satisfied that your best judgment will be used in dealing with them. The finances will be dealt with by the executive treasurer; therefore I will not touch on them. In conclusion, I desire to express to you my deep sense of gratitude for the great honor you conferred on me one year ago, when you elected me to the high and honorable position of president of this association, and for the loyal manner you have stood by me. In closing I will only add that it is my heartfelt wish that your deliberations at this convention will result in the advancement of the association.

On motion of Mr. Wickens, seconded by Mr Pettigrew, it was decided to refer the communication to the Committee on the Good of the Order for a report.

The minutes of last meeting were read by the secretary and adopted, after which the following committees were appointed:

Credential Committee—A. E. Edkins, J. W. Marr and F. W. Turkington.

Finance Committee—G. W. Webb, A. M. Wickens and R. C. Pettigrew.

Mileage Committee—J. J. Bain, J. Ironsides and W. F. Jameson.

MR. R. C. PETTIGREW, President.

Good of the Order—Jas. Dixon, A. M. Wickens, Chas. Moseley and W. Oelschlager.

The convention then adjourned for lunch.

AFTERNOON SESSION.

At 3 p.m. Mr. Oelschlager introduced Mayor Egan, who, after welcoming the delagates spoke as follows:

The Stationary Engineers fill a most important position in connection with the welfare of the country. In the first place they hold the key to our manufacturing industries, whereby the trade

and commerce of the land is very much increased. They also control to a great extent the labor employed in cities and towns, and without this employment, the cities and towns of our country would be very much reduced in prosperity and population. This must show to the engineers the necessity of each of you being intelligent and ingenious. A man to-day to be of any use in any profession must be more than a machine. You are showing your wisdom in forming yourselves into an association and meeting regularly to discuss new requirements in your particular lines. No doubt many of you are clever individually, but all can learn


MR. G. C. MOORING, Vice-President.

from one another. It should be your object to try and benefit your employer by giving him as much power as possible with the least expense. Now, as Mayor of this town, I extend to you all a hearty welcome to our town of Berlin—a town which we boast of as being the best in this fair Dominion—a town which employs to-day more stationary engineers than any other town of its size in Canada. I understand that only some of our engineers have as yet joined the association, but I trust your meeting here will act as a stimulus and result in having all our engineers identify themselves with the organization. Our town is known as a most hospitable one, and I can assure you the freedom of the city wherever you go. No doubt you will be most interested in our manufacturing establishments, and I can assure you from what I know of our manufacturers, it will be a pleasure for them to show you through their factories. I trust you will enjoy your visit here in such a way that you will see fit to meet here again in the near future, at which time we will have all our streets fixed up in keeping with the rest of the town. I again extend to you, friends, the freedom of our town.

The president acknowledged the hearty reception extended by the Mayor. He said he believed that the Dominion was destined to become one of the greatest countries in the world, and appreciating this truth, it become them as engineers to sow the seed


MR. A. M. WICKENS, Secretary.

of theory and practice combined, which were the fundamental principles of the Canadian Association of Stationary Engineers. The object of the association was to help one another socially and educationally, thus benefitting employers as well as themselves.

On motion of Messrs. Mooring and Edkins, the minutes of the last annual meeting were adopted.

Notices of motion were given as follows: That two days session be the limited time apportioned to conventions; that conventions in future be held every alternate year; that the per capita tax be reduced from 70 cents to 50 cents.

The reports of the treasurer and secretary were presented and adopted. The secretary's report embodied a letter from the Montreal association announcing the decision of Montreal No. 1 to withdraw from the Canadian association. A special committee was appointed to report as to the action to be taken in this matter.

The report of the Credential Committee was then read and referred to the Mileage Committee. Mr. Dixon presented a report from the Parliamentary Committee, and the convention adjourned at 4 p.m. to meet the following morning. In the evening many of the delegates visited Waterloo, where they were entertained by the local association and dined at the Progress House.

SECOND DAY.

Upon reassembling on Thursday morning, Mr. Wickens presented the report of the Finance Committee, and Mr. Dixon that of the Committee on Good of the Order. It was decided to take up the latter clause by clause. The clause referring to the limitation of the session of conventions to two days was struck out, the point being covered by the constitution. The report as adopted is as follows:

REPORT ON THE GOOD OF THE ORDER.

1. The President's address contains much that is essential to our vitality as an organization. His reference to our development


MR. CHAS. MOSELEY, Treasurer.

has a regretful aspect, but certainly the cause lay in the hands of those who it was possible to control, much less to coerce into activity.

2. The outlook for our extension in the near future is hopeful, inasmuch as enquiries have reached us from the Pacific coast regarding organization under our charter. We suggest that these enquiries be closely attended to by our present or incoming executive.

3. Relative to bill for the protection of stationary engineers, your committee appointed at convention found it impossible to act. The Ontario Association took the matter up with great enthusiasm and interviewed Hon. Mr. Dryden, M.P.P., who advised them to amend the bill and present it at the next session. Your committee desires to impress upon the individual membership the necessity of supporting this association in its praiseworthy efforts in our interests; further, we are of the opinion that a special committee appointed from this convention to act in conjunction with the Ontario Association would be a wise measure to adopt, and that the funds to assist in forwarding this object should be realized by special appeal of the executive to the primary lodges.

4. The president's suggestion that a past president be elected to the office of executive secretary we consider is a wise one, and we would recommend that the office be held for a term of not less than two years, and that the secretary, at pleasure of convention, be eligible for re-election.

5. We would recommend that the executive issue a circular to primary lodges inviting a plebiscite vote on the question of holding conventions annually or biennially, returns of said votes to decide.

6. We would recommend that the per capita tax be reduced from 70 cents to 50 cents. This would certainly be a boon to primary lodges, and if the biennially sessions are adopted, would still increase the general fund of the executive, as by paying 50 cents annually with expenses arising every two years, there would be 25 cents extra accumulate over and above the ordinary fragments

7. We beg to remind our executive that a motion stands on the book that they issue instruction and question papers. No course that we are cognizant of would be so effective in keeping our membership in close touch with each other, and we beg to emphasize this action on the executive as being of paramount importance.

After some lively discussion on the recommendations embodied in the above report, it was, on motion of Messrs. Edkins and Ironsides, adopted. The president read a telegram from the Goldie & McCulloch Co., of Galt, inviting the delegates to visit their works in the afternoon. It was decided to accept the invitation and wire the company to that effect. Mr. Oelschalger announced that the train would leave Berlin at 3 o'clock.

Mr. W. Oelschlager, Conductor.

VISIT TO THE GOLDIE & McCULLOCH WORKS.

In response to the invitation from the Goldie & McCulloch Co., of Galt, all the delegates visited the works of the above firm. The entire party expressed the greatest surprise at the immensity of this well-known establishment. Solidity seemed to be stamped on everything, their substantial stone buildings and offices covering more than one entire block. Mr. A. R. Goldie met the delegates and personally conducted them through the various departments. A visit to the moulding shop proved of very great interest, for here was found one of the finest foundries in the Dominion. It has an immense floor space of 90 feet by 160 feet. At one end is situated three large core ovens, and at the same end are also three very large cupolas. The ponderous ladles of molten metal are conveyed from these to their respective destinations by one large Whiting travelling crane of 40,000 lbs. capacity—this immense crane being operated entirely by compressed air. Supplementing this are six smaller hydro-pneumatic swinging cranes, three on each side of the floor. With these and other late equipments, it is not the difficult task it otherwise would be to handle the ponderous castings. The moulding shop is well lighted and ventilated.

The delegates next visited the machine shop, where was seen the very latest improved machinery in lathes, planers, etc. System and good management were apparent in every detail here, as in all the other departments of the works.

Perhaps no department proved more interesting to the engineers than the erecting room, for it is always interesting to engineers to see the assembling of the different parts of an engine. On this floor were to be seen engines in all stages of construction. Here were massive cylinders and immense frames carried here and there by powerful cranes to be united, fitted and finished, some of them to soon go out and develop 400 to 500 horse power for the work they have been purchased to perform. This was the department which most interested the engineers, and they saw why this firm have been so successful in engine building, thoroughness, system and great care being exercised in every minute particular.

The visitors were shown through the other parts of the works, such as the wood-working machinery department, flour mill machinery, safe, boiler and other shops.

Before leaving, the president, Mr. Chapman, in fitting words, tendered a very hearty vote of thanks to Mr. Goldie for his kindness in showing the delegates through the establishment and also to the firm, and three rousing cheers were given for the Goldie & McCulloch Company. Mr Goldie, in response, expressed his pleasure at being privileged to meet and entertain such an intelligent body of men. The delegates returned to Berlin about 8 p.m.

THIRD DAY.

The proceedings opened on Thursday morning with the presentation of the report of the Mileage Committee. On motion of Mr. Edkins, the name of Mr. Wickens was added to the list of persons to be given mileage expenses. Mr. Dixon moved, seconded by Mr. Moseley, that the report with addition be adopted. Carried.

Mr. Dixon presented the report to the Special Committee to deal with the letter from the Montreal association. While expressing regret that the association had withdrawn from the Dominion organization, the hope was expressed that ere long Montreal No. 1 would apply for representation again. The report stated that the committee had extended its power, and submitted a resolution that the Montreal association be presented with a charter of the association as a memento. This was carried unanimously by a standing vote, and, on motion by Mr. Edkins, seconded by Mr. Moseley, the report in full was adopted and ordered to be transmitted to the secretary of the Montreal association.

The question of making some changes in the bill for the licensing of engineers was left in the hands of the proper committee.

Mr. Mooring moved that a new Legislative Committee be appointed to work in conjunction with the Ontario association, and that the members thereof should reside in one city or near by each other. This was seconded by Mr. Pettigrew and carried. The president appointed as the Legislative Committee Messrs. Dixon, Edkins, Webb, Mooring and Moseley, Mr. Dixon to be chairman.

Upon motion of Mr. Moseley, this committee was given power to draw upon the funds of the executive for $50 for preliminary legislative work, in case this amount should be required.

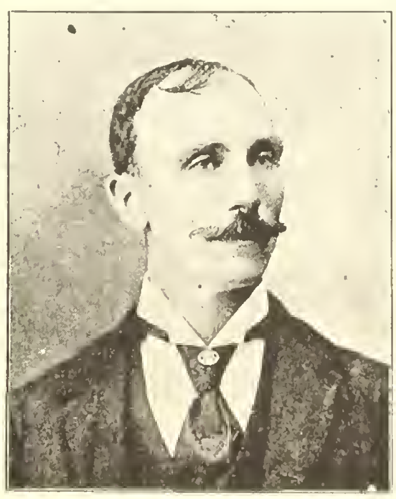
Upon motion of Mr. Wickens, seconded by Mr. Dixon, the incoming secretary was instructed to procure copies of the constitution and by-laws for the use of subordinate associations.

Mr. Jamieson reported that there were a great many engineers in the town of Petrolia, and he was of the opinion that an association could be organized there. He was requested to furnish the names of some of the engineers to the executive secretary.

Mr. Mooring announced that the committee had placed the value of property owned by the association at $109.50.

ELECTION OF OFFICERS.

The next business was the election of officers, for which purpose Messrs. Steinmetz and Walker were appointed scrutineers. The result was as follows: President, R. C. Pettigrew, Hamilton; vice-president, G. C. Mooring, Toronto; secretary, A. M. Wickens, Toronto; treasurer, Chas. Moseley, Toronto; conductor, W. Oelschlager, Berlin; doorkeeper, W. Bear, Dresden. The newly elected officers were then presented by Mr. Webb and duly installed. The thanks of the association were tendered to the scrutineers.



Mr. W. Bear, Door-Keeper.

The next place of meeting was then taken up. Mr. Oelschlager moved that the next convention be held in Toronto, which met with the unanimous approval of the convention.

The retiring president, Mr. Chapman, was presented with the usual past-president's jewel.

The acting secretary was granted $15 for his services, and

votes of thanks were tendered to the authorities of Berlin; to Mr. Wm. Oelschlager and the local committee; to the ladies of Berlin, and to the mechanical press. Brief speeches were made by the newly elected officers, which closed the business session.

In the afternoon the delegates drove to Waterloo, where they visited the Sleeman stables, the large button factory, and other industries.

THE BANQUET.

The programme announced a banquet at the Walper House in the evening. About seventy-five persons gathered around the tables in the spacious dining hall. Seated at the head table were Mr. Oelschlager, who acted as chairman; president Pettigrew; past-presidents Wickens, Phillips, Pettigrew and Chapman; vice-president Mooring; treasurer Moseley; conductor Baer; and Mr. Chas. Rogers, of the Queen City Oil Co., Toronto. There were also present Mr. G. B. Towers, of the Vacuum Oil Co., Toronto; Mr. J. H. Clappison, of the Clappison Pipe and Boiler Covering Co., Hamilton; Mr. T. J. Halsey, representing Fairbanks Company, Montreal; several of the town councillors and many prominent citizens of Berlin and Waterloo.

After the menu had received attention, the chairman made a brief address, and read letters of regret from Mayor Eden, Mr. J. J. York, Montreal, Mr. Wm. Sutton, Toronto, and the Goldie & McCulloch Co., Galt. Then the toast of "Our Queen" was royally honored, followed by the toast of "Canada Our Home," to which Mr. L. J. Breithaupt, M.P.P., was asked to respond. Mr. Briethaupt said he was pleased, as an employer of labor, to be present, and that he was in sympathy with such an association. The employer soon recognized the fact that an intelligent workman was saving him money. Employers could not get along without employees and vice-versa, therefore their interests were mutual. Referring more particularly to Canada, Mr. Breithaupt pointed out that there never was a time when the future of Canada was so appreciated and recognized as it is to-day. The exports to Great Britain were proportionately more in the last few years than ever before. Engineers, he thought, would be certain to derive some benefit from this prosperity. In conclusion Mr. Breithaupt referred to the activity in manufacturing in the town of Berlin, which he said was an example of the conditions prevailing all over the Dominion. Upon resuming his seat Mr. Briethaupt was heartily cheered.

The "Mayor and Council" followed, in which Dr. Bowlby, deputy reeve, councillors Rumpel and Hagen, and Mayor Deibel, of Waterloo, responded.

The chairman then called upon Mr. James Dixon for a song, he rendering in a most acceptable manner "And She Was Tired of Him," which, needless to remark, received a hearty encore.

Coupled with the toast of "The Executive Head" were the names of Messrs. Pettigrew, Mooring, Moseley, Wickens and Dixon. Mr. Pettigrew said that the association, with education for its corner stone and progress for its motto, had been the means of establishing technical schools throughout the country. It was organized only twelve years ago, but now extended from salt water to salt water. Speaking on legislation he said he failed to see why engineers were not as much entitled to protection as professional men. Mr. Mooring said that when he accepted office in the association it was with the intention of reaching the top, and this he hoped to do next year. Messrs. Moseley and Wickens spoke briefly, after which Mr. Dixon indulged in some humorous stories, one being of the small boy who, when asked by the professor what steam was, replied: "Steam is water in a terrific state of perspiration."

MR. ROGER'S SPEECH.

Then came the toast of "Our Manufacturing Interests," to which Mr. Samuel Rogers, president of the Queen City Oil Co., was the first respondent. Mr. Rogers said that as a result of his meeting with the engineers he would in future take a deeper interest in the prosperity of stationary engineers. Knowledge properly applied was what made the wheels of the world go round, and he was pleased that the stationary engineers association was for educational purposes. An employer greatly appreciated an honest, faithful employee, and the prosperity of engineers depended in a large measure upon the prosperity of employers. For the last ten years, he said, his firm had been shipping oil to Australia and New Zealand, and each succeeding year the quantity had doubled. Mr. Rogers then spoke at some length upon the manufacture of oil, giving a most interesting and instructive talk. He said in part:

"Crude oil is placed in the still, which ordinarily is charged with from 350 to 500 barrels. The still has a dome on the top, from which large pipes lead to the condenser, which is built in the shape of a flume. The flume is kept filled with cool water. Condenser pipes are joined with vapor pipes, which come direct from the still. As these condenser pipes are under water, the vapor from the still is condensed while passing through them, and comes out at the worm end in liquid form, but varying very much in quality in proportion to the length of time which the still has been running. The first vapors which come from the still are very light, and when condensed make a liquid of 90 gravity, which is called gasoline, being nearly ten degrees heavier than vapor. Formerly this product was all lost for want of knowledge and lack of capital to build up-to-date refineries. At present closed worm ends are used, so that even the gases which are uncondensable are secured and drawn back to feed the fire under the still. As the fire is continued the vapors grow heavier. Next to ninety gravity gasoline comes eighty-eight, then eighty-six gravity. All the above are used for making gas for lighting churches, mills, etc., by simply mixing air with the gasoline. After this comes stove naptha, ranging from seventy to seventy-four gravity, used for motor carriages, for summer cooking stoves and for plumbers' use. Then we get 62 to 64 gravity, used for benzine and naptha, from which varnish and other paints are made.

"After this we get down to the series from which refined burning oils are made. At this point it may be better to explain that crude oil is composed of molecules or little balls, which vary in size according to the gravity, and it is very important that a proper separation be made of all these different qualities. This is done by the stillman watching the worm end continually, and taking samples of the distillate at least every fifteen minutes, and as change takes place in the quality of the distillate, the stillman takes off the product of the still and runs it into different tanks, thereby making the first separation. After the refined series is passed, we get down to the heavier molecules from which gas oil, high fire test burning oil, high grade spindle and other oils are made. When the above point is reached, we get down to the heavier paraffine series, from which high grade engine and other machine oils are made, also wax candles and petroleum specialties.

"After all the above products have come from the still, in the form of vapor, passing through the condenser, and the different liquids separated at the worm end, there only remains in the still petroleum coke, which is used to make carbons for electric light plants, or for other heating purposes. The products thus far produced are all in a crude state, and require close and careful handling, having to be chemically treated. Many more separations are also made before the finished articles are ready for the market—there is not time to follow all these in detail. One million dollars has recently been spent in building a new refinery at Sarnia. Owing to this expenditure all grades of petroleum are now made in Canada equal in quality to anything produced in the United States. During the last three years wonderful advances have been made in manufacturing petroleum. Take for example one by-product, gas oil, which is a by-product from crude oil, a large quantity of which is used by gas companies for making gas (one company alone using 40,000 barrels per year). Roughly speaking, their method of using this oil is to build a high retort; this is filled in openly with fire brick, leaving an arch at the bottom in which a coal fire is kept burning, heating the fire brick red hot. A small stream of oil is then fed in the retort from the top. Live steam is also introduced into the retort, and all the oil is therefore converted into gas and smoke. As this is conveyed in vapor from the retort to the gas holder, it passes through a scrubber in which there is water. The water condenses the smoke into thick, heavy tar, mixed with water. The tar is afterwards taken to the varnish factory and put again into a still with a condenser attached. As the still is heated the vapor which comes from the tar is again condensed, and, strange to say, after the water has been all removed in vapor from the tar, there comes again a thin oil. This oil, which has once been made from crude oil and then made into gas oil and smoke, is again made into oil, which is used for making tar-paper by mixing with tar, or it can be burned as fuel for firing the still. The residue of the condensed smoke remaining in the still is made into pitch, electrical compound, Japan and many other articles. All of these products have been redeemed from the fire, while in the past many of them were lost, absolutely thrown away. The bringing into this country of new capital, coupled with the expenditure of millions of money in experiments and plant, has made Canadian oil equal to the best American, and if Canadians were only as loyal to their country as Americans are to theirs, no American oil would be bought so long as the Canadian supply held out. The Queen City Oil Company have from one hundred and seventy-five to two hundred employees engaged in the sale of this oil in Ontario. Every one of them are Canadians. The oil is equal to or better than the best imported, and the money received instead of going to the States is sent to Sarnia to buy Canadian crude oil, furnishing home work for thousands of Canadians and helping to build up a Canadian empire which is truly loyal to the British Crown, proud to live beneath the glorious flag of our beloved Queen."

Mr. J. S. Anthes, furniture manufacturer of Berlin, also spoke in response to the last-named toast.

Mr. Hugo Kranz spoke in response to the toast "Educational Interests." He declared himself in favor of technical education. Some years ago, he said, Germany was a purely agricultural country. The government decided to send an expert to the United States to report as to the products of industries and if Germany was equal with other countries. This expert reported in the negative, and as a result technical schools were started. To-day Germany occupies a foremost position among the manufacturing countries of the world, largely due to her system of technical schools.

The toast of "Sister Associations" came next. Mr. E. J. Philip, in responding, said that the Canadian Association of Stationary Engineers was the only association that gave a man a practical benefit that remained with him. Mr. Wickens followed, explaining the difference between the Canadian association and the Ontario association, and pointing out the necessity of having boilers in charge of competent men. An ordinary boiler, he said, had an explosive force equal to two kegs of gun-powder.

The toast of "The Press" was acknowledged by Mr. W.A. Smith, of the Canadian Engineer, T. S. Young, of the ELECTRICAL NEWS AND ENGINEERING JOURNAL, and by representatives of the Berlin press. Mr. Dixon then favored the audience with another song. Then followed the toast of "The Ladies," responded to by Mr. Dover and Mr. Geo. O. Philip; "Berlin and Waterloo Association," proposed by Mr. E. J. Philip and responded to by Messrs. W. Oelschlager, Geo. Steinmetz and J. Wendell; "Host and Hostess," by Mr. Philip, on behalf of Mr. A. Walper. The banquet was brought to a close by the singing of "God Save the Queen," and by giving three cheers and a tiger for Berlin.

CONVENTION FLASHES.

The Alpha Chemical Co., of Berlin, distributed among the engineers sample boxes of Moody's metal polishing paste.

Mr. Joseph H. Walker, chief engineer of the Kincardine electric light plant, although not a delegate, was a visitor to the convention.

Mr. G. O. Philip, a brother of Mr. E. J. Philip, is an engineer in heart, if not in practice. Someone suggested that he be made a life member of the association.

The thanks of the association are due Mr. Samuel Rogers, of the Queen City Oil Co., for a substantial contribution towards the expenses of the convention.

Mr. Geo. Steinmetz, vice-president of the Berlin association, is chief engineer at the power house of the Berlin Gas & Electric Light Co. He was at one time a traveller for engineers' supplies.

Even the oratorical powers of Mr. James Dixon, chief engineer at the Toronto city hall, were not sufficient to fittingly express the appreciation of the hospitality extended by the authorities of Berlin.

The Babcock & Wilcox Co., of Montreal and Toronto, displayed in the convention hall their "Beats All" improved pump governor, reducing valve, steam trap and Crosby steam gauge, which attracted much attention.

The local association were assisted in the entertainment of the delegates by Messrs. R. Wegener and H. D. McConachie, resident representatives respectively of the Queen City Oil Company and McColl Bros., Toronto.

Mr. Nathan Uttley, of Waterloo, may be said to be the father of engineers. Although 67 years of age, he is now firing under five boilers of 70 h.p. each in the Waterloo Woollen Mills, which position he has occupied for 18 years. His son, Mr. J. Uttley, is chief engineer of the plant.

That the engineers might remember the brands of oil manufactured by the Queen City Oil Co., Mr. R. Wegener, the local representative, placed in the hands of each person at the banquet a package of matches, each match bearing the name of some brand of oil made by his company.

Too much credit cannot be given to the energetic local committee for their faithful labors to make the convention a success. While every member was true to his duty, special thanks are due the chairman, Mr. W. Oelschlager. From the arrival of the first train until every delegate had departed from the town, he was ever on the alert to add to the comfort and pleasure of the visitors. Mr. Oelschlager is a member of the firm of Oelschlager Bros., engineers and machinists, of Berlin, who manufacture high speed engines, steam pumps, power and hand hoists, etc.

Mr. T. J. Halsey, of the Fairbanks Company, of Montreal, lost no opportunity to make known to the engineers the merits of the goods of his company. He had a choice exhibit of the Fairbanks renewable asbestos disc valves, asbestos pack cocks for boiler blow-offs, and lines of vulcabeston packing. A special feature of their Globe disc valves is the very simple manner of renewing the disc. They are held in a central position by guides cast on the valve body, and have no nuts, screws or pins to become detached in use. The discs can be put in place by simply removing the bonnet of the valve, slipping a new disc on the end of spindle, and replacing the bonnet again.

MOTOR CARRIAGE TRIP ON COUNTRY ROADS.

ON August 15th Mr. E. J. Philip, chief electrician for the T. Eaton Company, ran his motor carriage from Toronto to Berlin, to attend the convention of the Canadian Association of Stationary Engineers, of which society he is a past-president. Mr. Philip was accompanied by his mother, who is seventy-four years of age. The following account of the trip has been furnished to the ELECTRICAL NEWS:

"Leaving Toronto at 11.15 a.m., we arrived in Berlin about 8.30 p.m. About two hours was lost at noon and forty-five minutes at tea, making the running time about 6½ hours, or a speed of 12 miles an hour. This, of course, included stoppages to inquire as to the best route. The trip was made practically without a hitch, and the total load moved was about one ton, there being, besides the weight of the carriage, that of the passengers, an extra two gallon can of gasoline, and a valise. About four gallons of 74° stored gasoline and 11 pails of water were used on the trip. At 12.30, when on the road detween Brampton and Cooksville, a key fell out of a bronze pinion. It was found to be too long, and after cutting it off with the tools at hand, we were invited to partake of dinner by a farmer. When a start was again made it was 2.30, having lost two hours. The water tank was filled before starting,

MR. E. J. PHILIP AND HIS AUTOMOBILE.

and the run from this point to Georgetown was made without a stop except to inquire the way. At Georgetown the water tank was filled, some gasoline put in the tank, and the engine oiled up. From Georgetown to Guelph being all up hill, we used nearly as much gasoline and water on this run as from Toronto to Georgetown. Guelph was reached about 6.30 p.m., when we had supper, filled the water tank and oiled up. Leaving again at 7.20, we arrived in Berlin about 8.30.

"The return journey was made without incident. We left Berlin about 7 p.m., and ran down to Galt, stopped over night, left Galt at 7:15 a.m. for Hamilton, arriving at 9:30. The water tank was filled at Sheffield and Dundas; it was leaking badly all the way home, and lost more water than was evaporated by the heat. At Hamilton we took the boat for Toronto. The carriage caused much sensation along the road, and seemed to be regarded as a wonderful curiosity by men, women and children.

"The carriage was built by the Winton Motor Carriage Co., of Cleveland, Ohio, and weighs 1,600 pounds, with gasoline and water tank filled. The motive power is supplied by a 7½ h.p. horizontal gasoline engine; the cylinder and frame is cast in two pieces, and is made of bronze. It has a thin sheet brass jacket through which the cooling water circulates. The water tank is also made of this sheet brass, with plenty of ribs to give a sufficient radiating surface.

"The firing of the mixture is done by eight cells of Nungesser battery. The spark takes place between the platinum points, operated by a cam, and there is an explosion every second revolution. The distinctive feature of this carriage is the method of regulation. This is obtained by making the suction or admission valve stem very long, so that it extends through a head into a small cylinder. A piston is put on the stem in this cylinder, and between the little piston and head air is pumped by a smalll

air pump worked from the engine. On the pipe between the pump and controlling cylinder are placed two valves, one a set valve and the other being controlled by the foot at will. In starting up there is no air pressure in the small cylinder, and the valve can open wide, but as the engine speeds up, air is pumped into the chamber, the valve is kept closed, and the engine will slacken down and run slower, just keeping the air supplied that is escaping at the set valve. The engine will operate in this way when the carriage is standing still. The clutches not being in, in order to start the carriage, the operator, by pressing down the other valve with his foot, lets the pressure escape from the chamber, the valve will open wide, and the engine will speed up; the low or hill climbing clutch is now pulled in and the carriage starts off slow, the engine running fast; as it speeds up, the low clutch is thrown out and the high one put in; this direct connects the engine with the chain, and the carriage will now make about 18 miles an hour on a first-class road. The speed can be regulated by raising or lowering the foot. Within the range of speed of the engine to go slower, the low clutch is used; this low clutch lever when pulled in toward the operator drives the carriage ahead slowly, and when pushed away from the operator the carriage will back up. The high speed lever runs the carriage fast when pulled in, and by pushing it in the opposite direction it puts on a band brake that stops the carriage almost instantly. In case the brake should fail, the back-up gear can be used. These levers are operated by the right hand, the left doing the steering, which is as easy as steering a bicycle. The right foot controls the engine air valve, the left foot is at the bell, and the operation of the carriage becomes as unconsciously automatic as walking. The body of the carriage is hung on easy springs, the front wheels being 32-inch, the back ones 36-inch, and the tires Hartford 3-inch single tube.

"Some of the roads over which we passed were very hard on the tires, but as the horseless carriage comes into more general use, good roads must certainly follow. The distance to Berlin by the route we took was about 80 miles, and the return to Hamilton 37 miles. In and around Berlin the carriage must have covered about 100 miles, as six gallons of gasoline were consumed in the town, while only four gallons were consumed in going from Toronto to Berlin."

STEAM BOILER INSPECTION IN BRITISH COLUMBIA.

FOLLOWING are the rules for inspection of steam boilers and engines in British Columbia under the authority of the act passed at the last session of the Provincial Legislature.

MODE OF INSPECTION.

The inspector may, whenever he deems it necessary, and he shall at least once each year, subject every boiler in his district to a test by hydrostatic pressure, in the ratio of 150 pounds to 100 pounds per square inch allowable as a working pressure, using the water in such test at a temperature not exceeding 60 degrees Fahrenheit. For the purpose of such test, however, the owner or his agent shall provide the necessary pipe and fittings to connect the inspector's pump with the boiler, and shall also provide men to work the pump and assist the inspector in his examination of such boiler.

Before a boiler is subjected to a test by hydrostatic pressure, it shall be opened up for inspection, the man-hole and mud-plate doors removed, the outside and the inside of the boiler cleaned, the furnace grates removed and all flues and tubes swept clean. The owners or their agents shall see that the foregoing requirements are complied with before applying for inspection.

In any case in which a test is not satisfactory, the defects shall be made good and the boiler re-tested before a certificate is granted.

The inspector shall fix the working pressure of boilers by a series of calculations of the strength of the various parts, and according to the workmanship and material of which they are composed.

In order to satisfy himself as to the strength and internal condition of a boiler the inspector may, should he deem it necessary, order holes to be cut in it, and may so demand that such information, by drawings and specifications of the several parts, be furnished him of the construction as will enable him to determine, by calculation and examination, their strength.

In the event of satisfactory information not being obtainable, the inspector shall use the factor of safety provided above, with such additions as his judgment may dictate.

When the outside of a boiler cannot be otherwise perfectly inspected on account of brickwork or other covering, such covering shall be removed once at least in every four years.

In subjecting boilers made of iron plates to the hydrostatic test aforesaid, the inspector shall assume 100 pounds to the square inch as the maximum pressure allowable as a working pressure for a new boiler 42 inches in diameter, made of the best refined iron, at least one quarter of an inch thick, in the best manner and of the quality herein required, and shall rate the working pressure of all iron boilers, whether of greater or less diameter, according to their strength compared with this standard.

In subjecting boilers made of steel to the hydrostatic test aforesaid, the inspector shall assume 125 pounds as the maximum pressure allowable as a working pressure for a new boiler 42 inches in diameter, made in the best manner of the best quality of steel plate, at least one quarter of an inch thick, with all the rivet holes drilled in place, the plates being taken apart and the burrs removed, the longitudinal seams in the shell being fitted with double butt steel straps cut from the plate, and each at least five-eighths or over the thickness of the plates they cover, and all seams being at least double-rivetted, and having 70 per cent. of the strength of the solid plate, and all flat surfaces stayed in the best manner and all the seams double-rivetted; and he shall rate the working pressure of all steel boilers so made, whether of greater or less diameter, according to their strength compared with this standard.

If the inspector is of the opinion that any boiler, whether made of iron or steel plates, by reason of its construction or material, will not safely allow so high a working pressure as that hereinbefore specified for each such description of boiler respectively, he may, for reasons to be stated specifically in his certificate, fix the working pressure of such boiler at less than two-thirds of the test pressure.

When it is known or comes to the knowledge of the inspector that any steam boiler is or has been carrying an excess of steam beyond that which is allowed by the certificate of inspection, he shall, in addition to reporting the fact to the Attorney-General for prosecution under Sub-Section (3), Section (8), of the "Boilers Inspection Act, 1899," require the owner, or owners, of such boiler to place thereon a lock-up safety valve that will prevent their carrying an excess of steam.

On commencement of the construction of every boiler built in British Columbia under the provision of this Act, the maker of such boiler shall notify the inspector that it is open for his inspection.

The fees or dues to be paid yearly by the owners of steam boilers shall be 20 cents per horse-power, with a minimum of $5 for each boiler under 25 horse-power. The amount of such fees or dues shall in each case be paid to and received by the Inspector of Steam Boilers, who shall, at such time and in such manner as the Chief Commissioner of Lands and Works shall from time to time direct, account for and pay over the same to the Minister of Finance, to form part of the Consolidated Revenue Fund of the Province.

The inspector shall not make or deliver a certificate respecting any steam boiler under this act unless the fees or dues have been paid, as hereinbefore set forth.

DUTIES AND LIABILITIES OF ENGINEERS.

Engineers are required in all cases, upon stopping the engine, to open the safety valve, so as to keep the steam in the boiler below the limit allowed by the inspector's certificate; to close the dampers, and when by accident the water in the boiler has fallen below the point of safety, to put out the fires at once.

Engineers are required to report to the owner, and also to the inspector, any defects of or injury to the boilers or machinery, by which the safety of the same may be endangered.

They shall also report to the inspector any accident happening to the boilers or machinery; and in case of omission to make such report, the license of the engineer so omitting shall be revoked.

The chief engineer of a steam plant will be held accountable to the Department for the proper care and management of the boilers and machinery under his charge.

Engineers, on first taking charge of steam plants and at least once a year, shall satisfy themselves, by examination, that all braces, and stays, and bolts of the boiler are in good order, and that the safety valves are in thorough working order.

MANAGEMENT OF BOILERS.

Getting up steam.—Warm the boiler gradually. By getting up steam too quickly the boiler will soon be destroyed.

Firing.—Fire regularly. Use the slice bar gently and as seldom as possible.

Feed Water.—Let the feed be regular and constant.

Glass gauge and try cocks.—Keep the glass clean and free, and try the gauge cocks often.

Safety valves.—Lift each safety valve at least once each day, and always before getting up steam.

Low water.—Put out the fires by drawing them or throwing ashes on them. Never use water.

Blowing off the boiler.—Do not blow off by steam pressure; let the water run off if possible. See that the fires are all out and hot ashes removed.

Boiler purgers.—Never use any composition to keep down incrustation without the approval of the inspector.

TELEGRAPH and TELEPHONE

THE APPLICATION OF WIRELESS TELEGRAPHY TO THE PROPOSED SYSTEM OF BUOYS.

By F. A. Hamilton, M.I.E.E., M. Can. Soc. C.E.

My idea with regard to the possibility of using the Marconi system in conjunction with the electric gong buoys is based on the following considerations:

It is a generally recognized fact that some means of improving the approaches to Halifax harbor and other points on this coast must be provided. The subject has been discussed at intervals for years, but recent shipping disasters and more especially the increase of insurance rates have had the effect of so arousing public opinion that active measures are being taken with a view to carrying out some means of securing the desired result.

My proposal is to run a submarine cable from some suitable place near one of the headlands to a distance of about 12 miles off Sambro. Connected with the cable I propose mooring three buoys, placed in convenient positions, as described in the Canadian Electrical News of October, 1898, page 206, and in the Halifax public press in 1891-92, each buoy being fitted with an electric motor and other apparatus, such as bell, hammer and switch. The current would be generated at the station on shore, and each buoy would sound its own signal or number. Such a system of buoys could be maintained at a considerable less cost than would be incurred in the case of a lightship, and with more satisfactory results, for the former could be placed well out in the offing in water that would be beyond the depth in which a lightship could be moored. One of these buoys could be fitted, in addition to its ordinary apparatus, with a Marconi transmitter of sufficient efficiency to admit of signals being projected for a distance of a few miles, say four or five miles from the outer buoy.

By means of this combination provision would be made whereby vessels bound in would not be running into danger when searching for the buoys, and the latter would be so placed that the course of the ship standing to and fro would be parallel with the land. On passing to leeward of one of the buoys its number would be ascertained and a safe course to the harbor assured.

Ships having the Marconi receiver would be doubly served, and other vessels, such as the smaller sailing craft, would not be ignored. Such is briefly the scheme in outline.

With regard to the mooring of these buoys, I may say that a long experience in connection with submarine cable repairs justifies my conclusions with regard to the possibility of maintaining the proposed service at a cost which would not be prohibitory, and at an initial expense considerably less than would be required to provide and equip an efficient lightship, allowing for argument's sake that such a vessel could efficiently serve the purpose intended under circumstances when visual signals would be absolutely useless, seeing that thick weather is almost invariably the accompaniment during a southerly wind, and that vessels approaching the land are then standing down the wind and consequently towards a lee shore, frequently in dense fog which no light could penetrate. It may appear a vain repetition to recite the oft quoted experience of each and all of those who have studied the question of marine signals, that it is no unfrequent occurrence during intermittent fog for the passing mariner to see the jet of steam from a fog whistle, but without the faintest sound therefrom reaching him; and so with the automatic buoy, whose doleful moan can be heard for miles to leeward, but is inaudible a hundred yards to windward. Taking these facts into consideration, it would seem reasonable that the suggestions here submitted would commend themselves as proper subjects for investigation.

Halifax, August 8th, 1899.

POLICE AND FIRE ALARM SYSTEMS IN CANADA.*

By Geo. F. Macdonald, City Electrician, Ottawa.

You have asked me to prepare a paper on the progress and development of the fire alarm and police telegraph in the Dominion of Canada. Gentlemen, I appreciate the honor, I assure you. In my early occupation in commercial telegraphy we charged so much per word, therefore force of early training compels me to be as brief as possible.

The first alarm and police telegraph in Canada was established in Montreal in 1863, just 36 years ago. The "A.B.C." or dial instruments were used for police purposes. Montreal started with 53 boxes; to-day that city has 255. Montreal introduced the modern police alarm on street corners in 1884.

Toronto, the next largest city, installed the alarm in 1871 with 40 boxes; to-day it has 183, with 10 circuits and one of the most complete telegraph and underground systems to be found anywhere.

Quebec, the third largest city, built the alarm in 1867 with fifty boxes; to-day it has 100 boxes.

St. John, N.B., introduced the system the same year as Quebec, commencing with 25 boxes; to-day it has 61.

Ottawa, the capital of the vast Dominion, the "Washington of the North," commenced in 1874 with 30 boxes; to-day we have 100, and I am trying to get 50 more of the up-to-date pattern.

Halifax, N.S., Hamilton, London, and many other cities all have the fire alarm system.

Montreal and Toronto are the only Canadian cities having a perfect police patrol alarm. Montreal commenced to use the gravity battery in 1867.

The cities I have mentioned are using the keyless, non-interfering boxes, more or less. The day is fast approaching when we will have nothing but underground wires, non-interfering boxes and the storage battery system. I cannot close without acknowledging the great benefits derived by the introduction of the Gamewell repeater and the telephone in connection with our signal service.

* Paper read at the annual convention of the National Association of Municipal Engineers, September 4, 1899.

SHORT-CIRCUITS.

The town of Revelstoke, B.C., will install an electric fire alarm system.

The Bell Telephone Co. purpose renewing their line between Almonte and Pembroke, Ont.

The Bell Telephone Co. is said to be running a copper wire circuit from Montreal to Buffalo.

The bill providing for the payment by Canada of a proportionate share of the cost of the construction of the proposed Pacific cable was passed in the Dominion parliament on August 2nd.

The Georgian Bay Cement Company, Limited, of Owen Sound, Ont., have placed an order with the Canadian General Electric Company for the complete installation of an electric plant for 150 lights in their new works.

Mr. James Wilson, superintendent of C.P.R. telegraphs in British Columbia, returned a fortnight ago to New Westminster, after a three months' trip to Southern California. We are pleased to learn that Mr. Wilson's health is improving.

The annual meeting of the shareholders of the New Brunswick Telephone Co. was held recently at Rothesay, N.B., when directors were elected as follows: L. J. Almon, president; D. C. Dawson, secretary; Col. Tucker, A. O. Earle and James Kennedy.

A meeting of members of the town council and board of trade was held in Lindsay, Ont., recently, to decide whether a five years' exclusive franchise should be given to the Bell Telephone Company, or whether the newly organized Victoria County Telephone Company should be encouraged. The concensus of opinion seemed to be in favor of the Bell Company.

Messrs. A. E. Porter and W.A. Anderson, of Bennett, B. C., have made application to the Legislature of British Columbia for an Act to incorporate a company with the power to construct and operate a system of wireless telegraphy from some point at or near Bennett, in the district of Cassiar, to some point on the Canadian Pacific Railway between the eastern boundary of the province and the sea.

The demonstrations of Marconi's system of wireless telegraphy at the Toronto Industrial Exhibition are being conducted by Mr. W. J. Clarke, of the United States Electrical Supply Co., of New York. Mr. Clarke is a native of Trenton, Ont., and was for some years manager of the Hamilton Electric Light Co. The process of wireless telegraphy is shown operating with the receiver and transmitter about 15 feet apart.

Mr. Frederick Eli, of Newark, N.J., has patented a fire alarm box, intended to prevent the turning in of false alarms, as well as to give the fire department immediate notice of a fire. The invention consists of a cage, in which the fire alarm is located. When the door of the cage has been opened the door of the alarm box remains locked, and the door of the latter becomes unlocked as soon as the cage door is entirely closed. In this way the person ringing the alarm is compelled to remain in the cage until the firemen arrive to open the door by a key.

THE LATE JOSEPH H. KILLEY.

A PROMINENT citizen of Hamilton and a well known engineer passed away on August 10th, in the person of Mr. Joseph H. Killey.

Deceased was born in Castletown, Isle of Man, on April 24th, 1827. From his earliest years he had a great love of machinery. His parents purchased for him the work "Lardner on the Steam Engine," and this he mastered before he was twelve years old. At the age of fourteen he constructed a crude model engine and boiler. He went to Liverpool to learn the foundry business, and after five years entered the Vulcan Iron Works, owned by a cousin of the late W. E. Gladstone. Mr. Killey afterwards became foreman of a large foundry, and later mechanical manager and partner in the Windsor Machine Works, near Liverpool. In 1864 he came to Canada, obtaining employment with F. G. Beckett & Co., of Hamilton, and later became foreman of the St. Lawrence Foundry Co., Toronto. Then he was appointed engineer of the steamer Rothesay Castle, afterwards becoming engineer of the gunboat Prince Albert. After serving for three years on this boat, he built an oscillating and marine engine and boiler for the composite steamer Adelaide Horton.

Mr. Killey then established a business in a small way in the city of Hamilton, but it gradually increased to an important engine building concern. In 1870 the business was conducted under the name of J. H. Killey & Co., and in 1884 it became the Osborne-Killey Co. For some years after the winding up of this company he was associated with the late F. G. Beckett as the Killey-Beckett Co., manufacturing engines on a somewhat large scale. Among the machinery constructed by Mr. Killey were the pumping engines at Hamilton beach and the engine at the Asylum. For the past five years he has not been engaged in active business.

ELECTRICAL APPARATUS FOR WINDSOR CASTLE.

FOR the purpose of showing how cheap notoriety may be obtained, Fire and Water gives the true inwardness of the case out of which arose the statement recently published broadcast in the press that the order for electrical apparatus to be installed in Windsor Castle had been given to an American firm. The real facts of the case are these: A London firm received a contract for putting in a regular domicile electric fire alarm system in that royal residence. The boxes, wire, and special appliances for such work can be obtained at any electrical suppy house in almost any large city in this country or in European countries. From the fact, however, that through American ingenuity and machinery, goods of this kind can be made here and imported at a lower price than they can be purchased in England, the London firm in question decided to order from us. A Connecticut firm, which makes a cheap line of electrical goods, received an order for small bells and boxes, while the Gamewell Fire Alarm Company, of New York, was asked to furnish its special instruments, and another New York firm was patronized to a small extent to complete the order. There was no competition for the work on this side of the Atlantic, whatever there may have been in London, so the orders were distributed by the contractors as stated above. Of course, the fact that Her Majesty's principal home was to be equipped with American goods led the Connecticut firm to derive as much newspaper notoriety and free advertising as possible; and that it succeeded is very much to its credit as a clever stroke of business. The amusing part of the story is that those who had orders for the expensive patented instruments to be used in the installation were not referred to at all in the newepaper paragraph, and the amount of the order was not stated as being in the aggregate not more than $2,000.

THE LARGEST INCANDESCENT LAMP EVER MADE.

IT would seem at first sight ridiculous to construct incandescent lamps of a candle power comparable with that of arc lights, owing to the superior economy of the latter, but for one particular purpose the incandescent lamp is far preferable. That purpose is light-house illumination, in which the superiority of the incandescent is its greater fog penetration, the yellower rays of the glowing filament being dampened out and absorbed to a much less extent than the rays of an arc light. The Bryan-Marsh Company has on this account been experimenting on large lamps, the largest of which

A 5090 C. P. INCANDESCENT LAMP.

is one nominally of 5000 candle power, which was exhibited at the Electrical Show, and the magnitude of which can be judged from the accompanying reproduction of a photograph which is reprinted from the "Imperial Lamp Gazette." The lamp is of the standard double-filament type like the smaller Imperial lamps, the two filaments being in parallel with each other and each taking the full 236 volts. The economy was about 3 watts per candle, the total consumption of power being, therefore, some 15 kilowatts, requiring a current strength of over 60 amperes. The lamp was exhibited but three nights when it burnt out, owing probably to the intense heat to which the glass of the neck of the bulb was subjected. Owing to the fear that the filament would droop, the lamp hung in a position the reverse of that shown in the illustration, and the heat was very intense at the base, probably softening the glass, which then collapsed due to atmospheric pressure. A larger bulb in an upright position would eliminate this difficulty. The cost of construction and erection of this single lamp was over $1000.

THE MARITIME ELECTRICAL ASSOCIATION.

At a meeting of the Executive Committee of the Maritime Electrical Association held on August 31st, the resignation of Mr. R. T. McKeen having become imperative in consequence of his leaving the province, Mr. F. A. Hamilton accepted the vacant position of secretary-treasurer of the association for the remainder of the term, it being the unanimous wish of the other members of the Executive present at the meeting that he should undertake the duties. The services of Mr. McKean were cordially recognized by the Executive, all of whom wish him every success in his new sphere in Montreal, whither he is about to proceed for the purpose of studying at McGill College.

PERSONAL.

The Electrical News learns with deep regret of the sudden death of Mrs. Milne, wife of Mr. James Milne, manager of the General Engineering Co., of Toronto. Deceased was summering at Jackson's Point.

Mr. J. M. Campbell, who has spent the last two years in British Columbia, has returned with his family to Gananoque, Ont., where he will reside. Mr. Campbell is president of the Gananoque Electric Light and Water Supply Co.

The many friends of Dean Bovey, of the faculty of applied science of McGill University, Montreal, will be pleased to learn that he has recently been elected a member of the Council of the Institute of Civil Engineers of Great Britain. The honor is well bestowed.

Mr. E. W. Kelk, Hamilton agent of the Hamilton and Dundas Electric Railway, has removed to St. John's, Nfld., having accepted a position in connection with the Reid system of railways on that island. Mr. Kelk will also have charge of the telegraph system, some 660 miles in length.

Mr. Samuel S. Glass has been appointed chief engineer of the Victoria Jubilee Hospital at London, Ont. This hospital has recently been completed, at a cost of $100,000, and is equipped with a complete electric and steam plant. Mr. Glass is to be congratulated upon his appointment as chief engineer of this important institution. He was employed for over twenty years on the Grand Trunk railway as engineer, and has given much study to subjects pertaining to electrical and steam engineering. He is looked upon by his associates as up-to-date in all matters of mechanical detail, and is well qualified for his new position.

SPARKS.

An agitation is on foot at Wroxeter, Ont., to establish an electric light plant.

The village of Gatineau Point, Ont., will likely take over the electric plant now supplying light for the streets.

The council of Winchester, Ont., are considering an offer from Eager & Sanderson to light the streets of the village.

The Canadian General Electric Company are installing a lighting plant for the Expanded Metal & Fireproofing Co., Toronto.

On September 23rd the ratepayers of Weston, Ont., will vote on a by-law to raise $8,000 for putting in a municipal electric light plant.

The village of Shelburne, Ont., is preparing to enter into a contract for a ten years' franchise for lighting the streets. Tenders are invited by D. C. Dunbar, clerk, up to September 21st.

The Dominion Electrical Company has commenced business at Waverley, N.S. Mr. T. R. Gue, of Halifax, is one of the principal shareholders, and Mr. A. E. Porter, of Waverley, manager.

The Windsor Calcium Carbide Company are about to establish extensive works at Windsor, N.S. The promoters have secured an option on a water power capable of developing 2,500 h.p. the year round.

Messrs. McCurdy & Co. have disposed of their electric light plant at Sydney, C.B., to Mr. G. D. Whidden, late of Halifax. There are already 800 lights installed, and the system is constantly being extended.

The municipality of DeLorimier have accepted the offer of the Royal Electric Co. to supply arc lights at 33 cents per night, incandescent of 32 c.p. at 5½ cents per night, and incandescent of 65 c.p. at 11 cents per night.

Bennett Bros., who own and operate a flour mill at the corner of Parke and Market streets, Hamilton, Ont., are installing in their premises a 40 h.p. S.K.C. motor to drive their mill, power being supplied by the Cataract Power Co.

The Owen Sound Electric Illuminating & Manufacturing Company have been given a contract to install in the factory of the North American Bent Chair Company a 500-light incandescent plant and motors for driving the machinery in the building.

The Sarnia Street Railway Co. have re-elected directors as follows: President, J. S. Symington; vice-president, S. A. McVicar; secretary and manager, H. W. Mills; directors, Chas. Mackenzie, John Cowan, J. H. Jones, Jas. Fliutoft and Frank Smith.

Messrs. A. Campbell and John McGregor, representing eastern capitalists, have secured an option on the Boundary Falls water power and the franchise for the electric lighting of the town of Greenwood, B.C. It is said to be their intention to install a plant.

The town council of Almonte, Ont., have been unable to come to an agreement with the Almonte Electric Light Co. regarding the price to be charged for street lighting, and have decided to submit a by-law to the ratepayers on September 25th to raise the sum of $30,000 for the purpose of establishing a municipal plant.

A new smelter is under construction at Columbia, B.C., in connection with which an electric plant will be put in. The contract is said to have been given to the Westinghouse Electric & Manufacturing Co., of Pittsburg, Pa., for two alternating current generators of 180 k.w. each. These will be direct connected to a 250 h p. turbine.

The Hamilton Screw Works, of the city of Hamilton, are another of the converts of electric power, having shut down their steam plant. They are being supplied with power from the wires of the Cataract Power Co. The Royal Electric Co., of Montreal, are installing one of their 40 h.p. S. K. C. two phase motors. This adds another smokeless chimney to the many now in Hamilton.

The Alberta Railway & Coal Co., Lethbridge, N. W. T., has ordered two 150 horse power Mumford improved boilers from the Robb Engineering Co. They have had three of them in use for about half a year, and this order speaks well for the satisfaction they have given. The makers of these boilers claim they are more efficient than any other type in use, while they cost less than a water tube boiler.

A feature of the National Export Exposition at Philadelphia will be an exhibit by the International Correspondence Schools, Scranton, Pa., illustrating their method of teaching by mail. The bound volumes of their instruction and question papers, as well as work done by students, including numerous drawing plates, may be inspected by visitors, and a representative will be in charge to give full particulars.

The Electrical News acknowledges receipt of an invitation from the Eugene Phillips Electrical Works, Montreal, to attend the twenty-first annual Rhode Island Clam Dinner tendered to the electrical fraternity by Mr. Eugene F. Phillips, general manager of the American Electrical Works, of Providence, R.I. This popular event will take place at the Pomham Club in Providence on Saturday, September 9th.

A compound friction car brake has been invented by J. H. K. McCollum, of Toronto, and is now being used on some of the cars of the Toronto Street Railway Company. The brake can be applied to the axle of any car, and obtaining its power from the momentum of the car, costs nothing to operate. Patents have been secured in Canada and the United States, and a company is being formed to exploit the invention.

The council of the town of Rat Portage, Ont., are calling for tenders up to September 7th for an electric light and fire alarm service. Propositions are to be submitted as follows: 1, for a complete incandescent system of 41 lights; 2, for a complete arc system of 30 lights; 3, for a complete system of part arc and part incandescent, of 15 arc lights and 25 incandescent lights; 4, for use of four telephones as may be placed and directed by council; 5, a fire alarm system; 6, cost per additional light if required.

The Ragged Rapids-Orillia electric power transmission scheme is now fully under way. The Electrical Maintenance & Construction Co., of Toronto, are the contractors in charge of the work. The entire electrical machinery, consisting of two 300 k.w. S.K.C. two-phase generators, with 600 k.w. in step-up and 600 k.w. in step-down transformers, as well as the necessary switchboards and station apparatus, and one 50 h.p. induction motor to drive the waterworks pumps and one 50 h.p. induction motor to operate the arc machine, is being furnished by the Royal Electric Co. Rapid progress is being made, and it is expected that light and power from Ragged Rapids will be in Orillia between November 15th and December 1st.

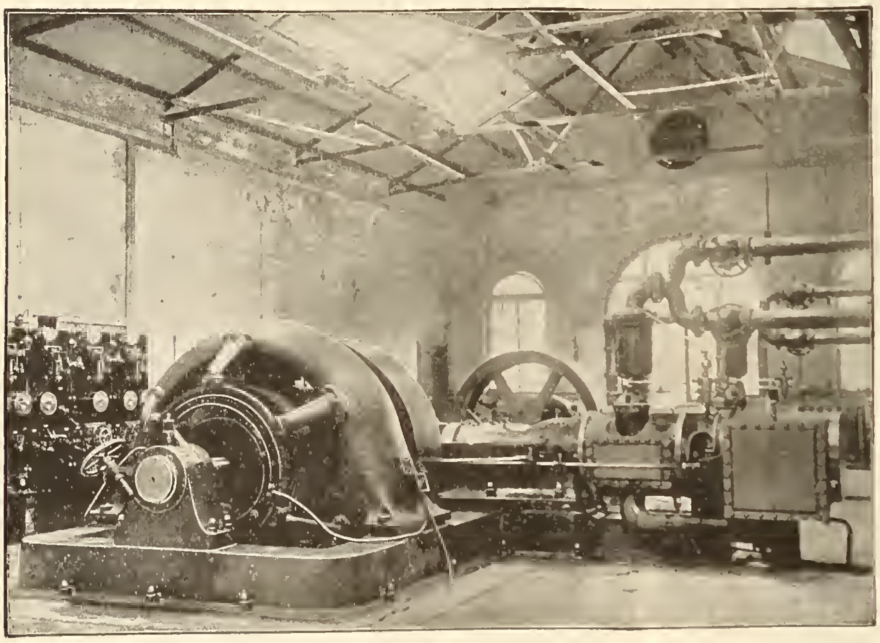
ELECTRIC RAILWAY DEPARTMENT.

ISLE OF MAN TRAMWAYS.

THE Isle of Man is the gem of the Irish Sea. It is only 33 miles long and 12 miles wide, but every acre of its green, gorse-grown hills and rugged coast line is beautiful, and the quaint Manx language and customs which still survive make it doubly interesting to the visitor. It is situated almost in the centre between England, Ireland and Scotland, and being within easy reach, by swift steamers, of Manchester, Liverpool and Glasgow, has become a favored summer resort.

Douglas, the principal town, situate on a beautiful bay, has a fixed population of about 30,000, which in summer rises to about 50,000. Every steamer from Liverpool and other ports, of which there are several daily, bring hundreds who spend a few hours, days or weeks in this lovely spot. One of the chief attractions is the beautiful glens which indent the coast line, running up into the interior of the island between the hills.

The Isle of Man Tramways Co., which operates an extensive system of cable and electric tramways in Douglas, has recently extended its electric line from Douglas to Ramsey, the next largest town in the island. The tramway runs around the precipitous cliffs overlooking the sea, skirting the beautiful Groudle, Laxey and Ballaglass glens. This drive, about 14 miles in length, winding in and out in full view of the sea, in an open electric car on a bright summer day, is superlatively beautiful and most invigorating.



INTERIOR OF POWER STATION, BALLAGLASS, I. O. M.

The recently completed extension of the I. O. M. tramways is a fine example of modern railway building and electrical construction. It is double tracked throughout, the road bed is rock ballasted, and the bridges and culverts are of solid masonry. The overhead trolley is used, all the details of electric work being of the latest and best design and construction. Two large accumulator stations are used to equalize the load and assist the cars over the steep grades.

The motive power of the tramway is supplied from five power stations placed at various convenient points throughout the extensive system. The illustration represents the interior of the largest and most complete power station at Ballaglass; it contains two 150 k.w. electric generators manufactured by the Electric Construction Co., of Wolverhampton, England, directly connected to two 250 h.p. tandem compound condensing Robb-Armstrong engines, manufactured by the Robb Engineering Co., of Amherst, N. S., Canada, for Messrs. Dick, Kerr & Co., of London, who were contractors for the equipment. The station is also provided with two standard Galloway boilers and Ledwards electrically driven ejector condensers. Adjoining the power station is a large accumulator power house—the whole making one of the most complete railway power houses in Great Britain.

All the work of the Ramsey extension, including road bed, electric lines and power stations, was engineered by the company's most efficient staff of engineers. Mr. Alexander Bruce, manager of Dumbel's Bank, is chairman of the company, and with his usual energy and persistence has done much to advance its interests. Dr. Farrell, one of the original owners of the tram car lines in Douglas, is also an active director.

SPARKS.

The Winnipeg Street Railway Company will likely build new car barns next year.

The Rock Lake Mining Co., of Thessalon, Ont., will likely construct an electric railway from Bruce Mines to their mine.

Promoters will apply at next session of parliament for incorporation of a company to construct a railway between Ottawa and Brockville, to be operated by either steam or electricity.

The first passenger car of the Metropolitan Electric Railway Company ran into Newmarket on Saturday, September 5th. Cars are now running regularly, covering the distance of 30 miles in one and ono-half hours. The new power house is located at Bond Lake, about 18 miles from Toronto, and it is the intention to close up the old station at North Toronto.

The Nelson Street Railway Co., of Nelson, B.C., have elected the following officers: F. W. Peters, president; T. J. Duncan, vice-president; T. C. Duncan, secretary; C. S. Drummond, Emile Gareke, W. A. Macdonald and J. Laing, stock directors. A contract for the electric equipment of the road has been given to the Canadian General Electric Co., of Peterboro', Ont. The power house will be built at the eastern boundary of the city.

Dr. N. H. Edgerton, of Philadelphia, the inventor of the high tenson storage battery, is building a factory at Hamilton for their manufacture in Canada. Work on the building is progressing. A temporary building, however, has been obtained, in which the immediate requirements in that line will be manufactured as soon as they can put the machinery in place. This means another electrical industry for Hamilton, which will employ about 50 men. The equipment of electrical instruments and switchboards was given to the Royal Electric Co., who are to have the same in operation within two weeks. Storage batteries for street railway purposes are to be the speciality of this concern, and with the advent of the electric carriages an immense field will be opened for this class of apparatus.

SPARKS.

The Canadian General Electric Company are installing a plant for Mr. A. MacLaren, of Wakefield, P.Q.

The Hamilton Electric Power Co. have installed an electric light plant at the Palmerston Pork Packing Co.'s works.

It is reported that the management of the Niagara Falls Metal Works at Niagara Falls, Ont., is considering the construction of automobiles.

A by-law to raise $20,000 to purchase the existing electric light plant or install a new one at St. Johns, Que., was defeated by the ratepayers last month.

The Kootenay Electrical Supply & Construction Co., of Nelson, B.C., have decided to open a branch at Grand Forks, with Mr. W. P. Dickson in charge.

The contract for electric lighting for the new Dominion Steel Co.'s works at Sydney, C.B., is said to have been awarded to the Maritime Electrical Co., of Halifax.

The Canadian General Electric Co. are installing one of their 30 k.w. generators, direct-connected to a Goldie & McCulloch Ideal engine, for the William Davies Company, Limited, Toronto.

Mr. Chas. W. B. Lawrence, proprietor of the Oakville electric plant, has just installed a new 60 k.w. single-phase alternator purchased from the Canadian General Electric Company.

The Berlin Gas & Electric Light Co. are reported to be considering the building of an electric railway to Preston. Should this be decided upon a new power house will likely be erected.

The ratepayers of Kamloops, B. C., recently approved of a by-law to raise $10,000 to extend the electric light plant. Mr. Willis Chipman, C.E., of Toronto, will have charge of the work.

The Canadian General Electric Company have just received an order from the West Kootenay Power & Light Company, Rossland, B.C., for another of their standard 30 h.p. three-phase induction motors.

The name of the Cataract Power Co., of Hamilton, has been changed to the Hamilton Electric Light & Cataract Power Co., and permission is given to increase the capital stock from $250,000 to $3,750,000.

The Montreal Cotton Company are continually increasing their electric development, and have placed an order with the Canadian General Electric Company for two additional 75 h.p. and one 5 h.p. three-phase induction motors.

George C. Hinton & Co., of Vancouver, B. C., have placed an order with the Royal Electric Co. for one of their 10 k.w. multipolar generators and the necessary wiring of lamps for one of their mining camps on Vancouver Island.

Toronto and Ottawa capitalists have formed a joint stock company for the purpose of taking over the business of five of the largest bicycle firms in Ontario. It is said that this company will also engage in the manufacture of automobiles.

The Wm. Kennedy & Sons Co., Ltd., of Owen Sound, Ont., are installing a new electric plant at their works, and have purchased for the purpose, from the Canadian General Electric Co., one of their standard 25 k.w. multipolar generators.

Mr. F. A. Huntress, manager of the Halifax Tramway Company, has recently returned from a trip to the West Indies, having visited Barbadoes, Port Au Prince and Georgetown, all of which have favorable openings for electric street railways. It is expected that important franchises will shortly be secured by Canadian capitalists, and that Halifax parties will be interested.

The Engineering Contract Company, of 603 Temple Building, Toronto, (Henry F. Duck, manager), has been awarded the contract for the construction of a concrete dam, sluice-ways, bulkhead, flume pipe supporters, power house foundations and tail race at Chaudiere Falls, near Point Levis, for the Canadian Electric Light Company of Quebec. The company will shortly award contracts for the power house, hydraulic and electric machinery, and the transmission line. The engineers of this work are Messrs. T. Pringle & Son, of Montreal.

MOONLIGHT SCHEDULE FOR SEPTEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 7.00	A.M. 3.10	8.10
2....	" 7.00	" 4.10	9.10
3....	" 7.00	" 4.30	9.30
4....	" 7.00	" 4.30	9.30
5....	" 7.00	" 4.30	9.30
6....	" 7.00	" 4.30	9.30
7....	" 7.00	" 4.30	9.30
8....	" 7.00	" 4.30	9.30
9....	" 7.10	" 4.30	9.20
10....	" 7.50	" 4.40	8.50
11....	" 8.40	" 4.40	8.00
12....	" 9.30	" 4.40	7.10
13....	" 10.40	" 4.40	6.00
14....	" 11.00	" 4.40	5.40
15....	" 11.50	" 4.40	4.50
16....	....	" 4.40	3.40
17....	A.M. 1.00	.....	
18....	No Light.	No Light.	.....
19....	No Light.	No Light.	.....
20....	No Light.	No Light.	.....
21....	No Light.	No Light.	.....
22....	P.M. 6.20	P.M. 8.40	2.20
23....	" 6.20	" 9.20	3.00
24....	" 6.20	" 10.10	3.50
25....	" 6.20	" 11.00	4.40
26....	" 6.20	A.M. 12.10	5.50
27....	" 6.20	" 1.00	6.40
28....	" 6.20	" 1.00	6.40
29....	" 6.20	" 2.00	7.40
30....	" 6.20	" 3.00	8.40
		Total.........	177.10

TRADE NOTES.

The Rossland Sentienel have installed in their printing establishment one of the Royal Electric Co.'s S.K.C. two phase motors to drive their presses.

The Dominion Cotton Mills Co., of Montreal, are installing in their mill a 300 k.w. S. K. C. synchronous motor. This is in addition to a number already placed.

The British Columbia Southern Mine, Limited, operating the Gertrude Mine in Rossland Camp, B. C., have placed their order for a complete lighting plant with the Royal Electric Co., Montreal.

The Aptus Veneer Company, of Albert, New Brunswick, have placed their order with the Royal Electric Co. for a complete electric lighting plant for their works, the plant to be in operation within four weeks.

Work has begun on the development of the Shawenegan Water & Power Co.'s plant at Shawenegan Falls, Quebec, and is being pushed night and day. The Royal Electric Co. have installed for the contractors one of their T. H. arc machines and lamps, lighting the entire work.

The corporation of Goderich, Ont., after receiving report of committee appointed to visit and investigate a number of plants installed by different manufacturers of alternating current apparatus, have awarded a contract to the United Electric Co., of Toronto, for one of their 60 k.w. inductor alternators.

The Iron Mask Gold Mining Co., of Rossland, B. C., are enlarging their electric hoist and air compressor, and have placed their order with the Royal Electric Co. for one of their 120 k.w. S.K.C. synchronous motors. The first order received by the above company from the Iron Mask Company was for a 75 k.w. S.K.C. motor. This was found not large enough for their requirments.

The Wm. Sutton Compound Co. of Toronto, Limited, have now added to their very extensive stock of engineers' supplies, which includes oils, grease, lubricators, belting, lace leather, flue cleaners, rubber packings, etc., a very large, complete and select stock of asbestos in its many forms, being of the finest Canadian and German manufacture, including millboard of all thickness, sectional pipe, elbows, tees, valve covering of every size, cement paper, building felt, rope and wick packing of every size. They wish to inform their many patrons that they can sell this class of goods at most reasonable prices and with prompt delivery. Any enquiry to the company's office, 185 Queen street east, in regard to any particular branch of their extensive business, will receive every courtesy and prompt attention.

Henry Morgan & Co., of Montreal, recently asked for tenders for two 75 k.w. and one 50 k.w. direct connected generators and engines for lighting and power for their departmental stores. Tenders were received for apparatus manufactured by the United Electric Co., Ltd., Toronto; Canadian General Co., Peterboro'; Royal Electric Co., Montreal, and the following American firms; Ridgeway Dynamo & Engine Co., Crocker-Wheeler Co., and Eddy Electric Co. The contract has been awarded to the United Electric Co., of Toronto, for the entire apparatus.

The well known electrical firm of Julius Sax & Co., of 119 Coldharbor Lane, London, S.E., has been taken over by a new combination, of which Mr. H. Salmony is the managing director. The firm of J. Sax & Co. has been established for 50 years, and at the world's exhibitions of 1862, 1882, 1883, 1884 and 1886 in London, 1879 in Sydney, 1881 in Melbourne, and 1881 in Paris, secured gold medals for their exhibitions. As artistic metal-workers, manufacturers of telephones, fire alarm appliances, bells, railway signal material, and all bell-work appliances, they have the reputation of standing alone in the British electrical world as makers of high class work. The special sphere of the business is the carrying out of government contracts. The new managing director, Mr. H. M. Salmony, has a very large trade connection with the electric lighting and tramway world of Great Britain; but as the present works of J. Sax & Co. will be fully occupied with the manufacture of the above mentioned goods, it is impossible for the firm to manufacture the material required for lighting and tramway systems. Consequently, Messrs. J. Sax & Co. are ready to take up agencies for motors, arc lamps, railway supplies or any similar articles required in the trade. The present members of the firm have made prolonged visits to America, and are ardent admirers of American motors, enclosed arc lamps and switches. The firm occupy an extremely strong financial position, and have arranged for all transactions to be on the basis of cash payments. Apart from this they are prepared to give highest references, which will strongly recommend them as agents for American houses.

Mr. Robert Anderson, of Ottawa, who has been awarded the contract for supplying arc lighting to the town of Arnprior, Ont., for the next five years, expects to have his plant in operation within three months. He expects to supply incandescent light also.

The corporation of the town of Liverpool, N.S., are installing a complete electric plant to furnish arc and incandescent lights for the streets and incandescent lights for indoor use. The by-law was voted on some time ago, and last week an order was given to the Royal Electric Co. for a complete electrical equipment, consisting of a 75 k.w. S.K.C. two-phase alternating current generator, with exciter and switchboard complete, also a complete switchboard and regulating apparatus for twenty-five 2000 c. p. enclosed alternating arc lamps for the streets, as well as the necessary transformers and materials for installing 2000 incandescent lamps, the whole plant to be in operation within six weeks.

SHUTTING OFF STEAM.

"Shall we stop our advestising for a while now?"

This is a question that some business men are apt to ask themselves, particularly in the summer, or during what they regard as their "dull season."

Suppose your engineer asked you:

"Shall I stop putting coal on my fires, sir?"

What would you reply?

"Why no—unless you want the engines to stop."

The advertiser who thinks of discontinuing may argue, "We have been advertising so long and so steadily that our name and specialities are well known, and we intend to advertise again when business is better in our line than it appears to be now; in the meantime our business won't stop."

No; neither will the engine stop the minute the men suspend shovelling in the coal. The point is, however, that when the engine is to be started again, ten times as much will have been lost in power as has been saved in fuel or feed.

Using up reserve force never pays.

It is a loss, however it may be looked at. The buying public is prone to forget. It is, moreover, much more difficult and much more expensive to regain a lost customer than to prevent his straying away.—Money Maker Magazine, Chicago.

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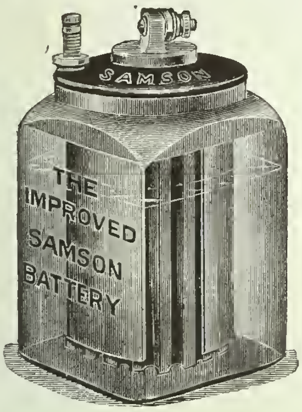

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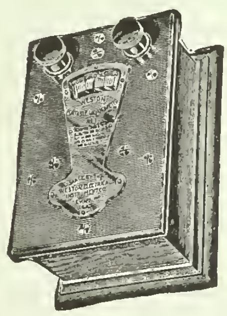

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MILLIAMMETERS, GROUND DETECTORS AND
CIRCUIT TESTERS,
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OCTOBER, 1899

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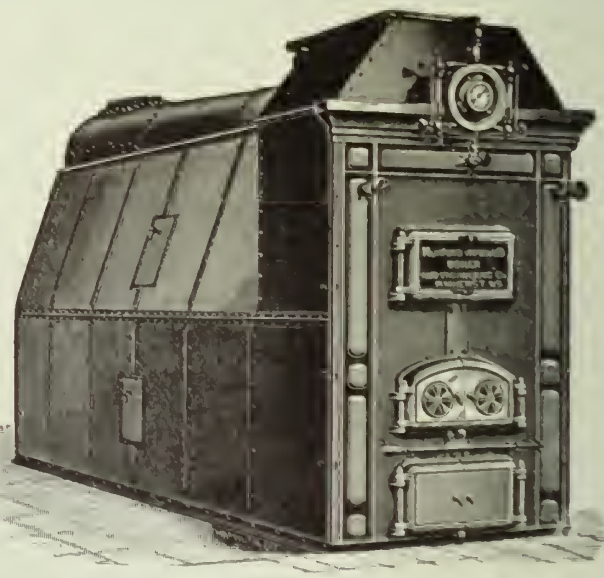

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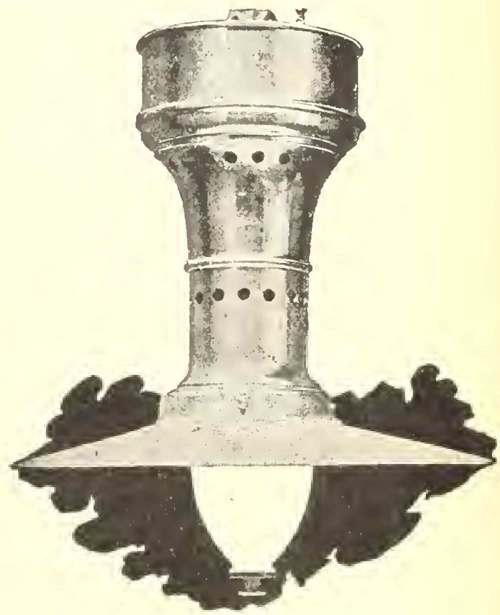

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VOL. IX. OCTOBER, 1899 No. 10.

THE KOOTENAY-ROSSLAND POWER TRANSMISSION.

DESCRIPTION OF THE SUB-STATION AT ROSSLAND—APPLICATION OF THE POWER FOR MINING PURPOSES.

IN the ELECTRICAL NEWS of September, 1898, there were published illustrations and a description of the water power, generating station and pole line of the

FIG. 1.—THE SUB-STATION AT ROSSLAND.

West Kootenay Power and Light Company, of Rossland, B.C. By the plant of this company power is transmitted from Bonnington Falls, on the Kootenay river, to Rossland, a distance of about thirty miles. Below will be found a very complete description of the sub-station at Rossland, and of some of the installations at the mines, for which we are indebted to the Journal of Electricity :

The transmission line enters the sub-station at Rossland through portholes lined with eight-inch terra cotta piping similar to those provided at the power house. As one enters the door of the sub-station the standard General Electric lightning arresters used are placed on a marble board in a corner at the left. The choke coils used are an innovation, in that each consists of a core twelve inches or so in length turned in the center of a stick of kiln dried and well filled timber about five inches square by from six to eight feet long. About this core insulated wire is wound until the space is filled, so that the choke coil thus formed resembles an exaggerated form of spark coil with its terminals carried out to the respective ends of the timber on which it is wound, these timber ends being strapped to the top of high tension insulators through which the choke coil is cut into the line. Such choke coils are placed in every line, not only at the sub-station but at every power service. Originally the Rossland sub-station contained but six 250-kilowatt step-down transformers, although six others, each of equal capacity, have since been installed, together with a new 1,500-kilowatt generator. The line wires are carried to the high tension switchboard at the rear of the station on high tension insulators supported by framings that hang from the roof girders, and the usual facilities are provided to afford safety and celerity in the handling of both the high and low tension sides of the transformers. These latter are of the same type and size as those installed at the power house, with the exception that the primaries take either 9,600 or 16,600 volts, according to whether connected in delta or Y, while the secondaries deliver 2,200 volts in three-phase current, which is the potential used on all the lighting and power distributing circuits in and about Rossland.

Here may be explained the very meritorious method which the electrical engineer of the West Kootenay Power Company, has devised for applying the air blast to the transformers at the power house and at the Rossland sub-station. As in the power house, the blast is supplied by three sixty-inch blowers, each driven by belting from a two horse power 100-volt induction motor. Instead of carrying this air blast to the transformers through small air ducts as is usually done, the engineer of the Kootenay plant has provided subways large enough for a man to enter and move about in. The manner in which the blowers supply air to these subways is shown in the end elevation of the sub-station, while the subways themselves, as is shown in the side elevation, extend in line with and directly under each row of step-down transformers. The idea of this arrangement will be understood when it is stated

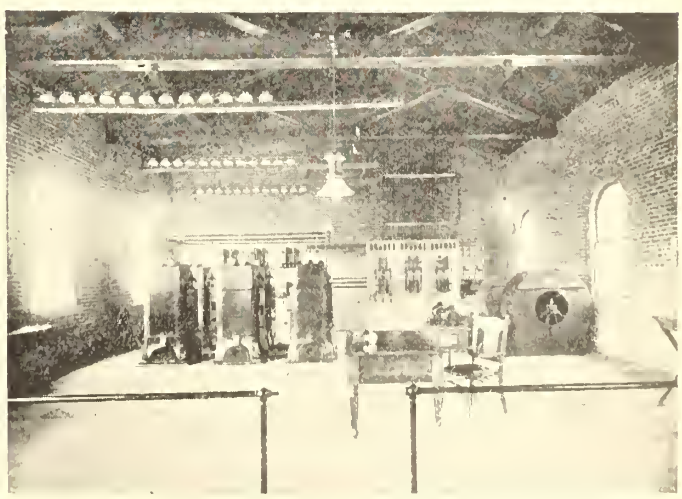


FIG. 2.—INTERIOR OF SUB-STATION AT ROSSLAND.

that each week the transformers are cut out of service one by one and the air ducts in them are each and every one examined and cleaned by a man who enters the subway in order that he may have access to the lower end of the air ducts in the transformer. His

work in cleaning the transformers is facilitated by the use of compressed air, which is obtained in both the power house and the sub-station from a single drill compressor driven by an induction motor. It is safe to say that so long as this method of transformer examination and cleaning is faithfully carried out the Kootenay transmission will never lose a transformer from the choking of its air ducts. Slides for regulating the amount of air to be delivered to each transformer are provided, and of course the subway is always air tight, and the man who cleans the transformers is under the

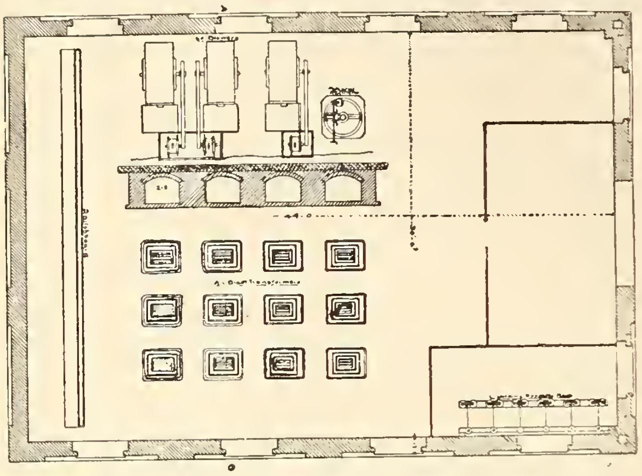


Fig. 3.—Floor Plan of Sub-Station at Rossland.

increased atmospheric pressure of the air blast while at his work.

The photograph showing the interior of sub-station was taken shortly after the plant started operations, and since then important additions have been made. The distributing switchboard at the right in the rear has had new panels added to it to accommodate other circuits. The third blower has been added, and immediately in front of it, as shown in the floor plan of the sub-station in Fig. 3, has been placed the induction regulator by means of which the potential of the outgoing lighting service is controlled by the sub-station attendant in-

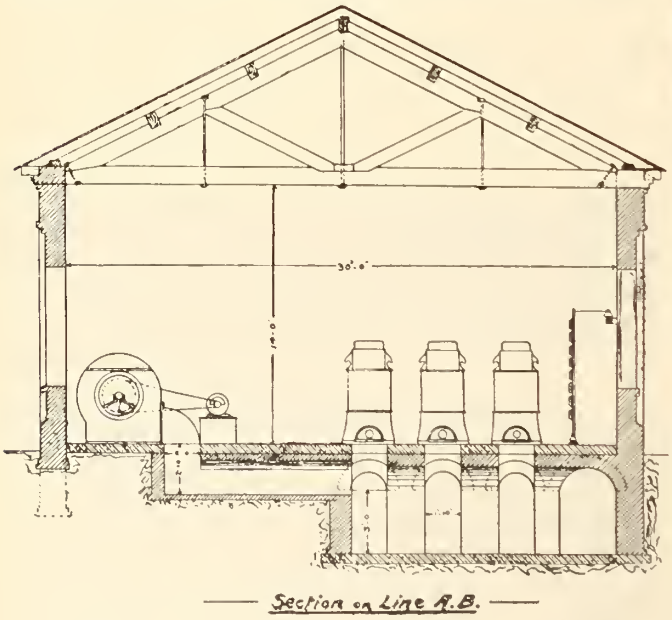


Fig. 4.—End Elevation of Sub-Station at Rossland.

dependent of the power house. This is a new device of the General Electric Company, bearing the designation "type I. R. T., class 4-20-60, form A." It is wound for seventy amperes per phase at 2,200 volts, and has a range of 220 volts in either direction. It is described as consisting of an induction motor with a vertical shaft, which is connected through bevel and worm gearing to the shaft of a pilot motor placed on top of the case so that the rotor of the induction regulator may be made to turn a given arc in either direction, and in so turning raises or lowers the electromotive force in the primary mains passing through the stator windings as desired. The pilot motor is manipulated from a single double-pole, double-throw

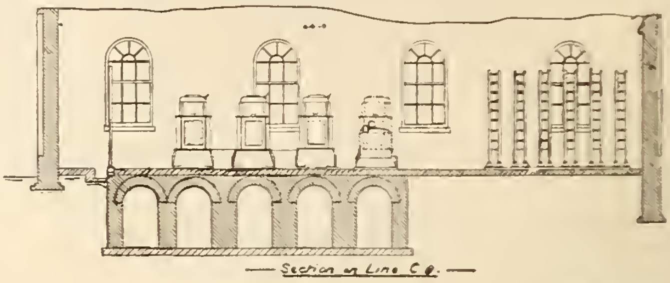


Fig. 5.—Side Elevation of Sub-Station at Rossland.

reversing switch placed on the switchboard; and this motor too is an induction motor. All details of this novel regulator, together with those of the limiting switch placed thereon, are given in Fig. 11. At present this regulator is used only on the lighting circuits, nor is its use contemplated on the power service.

All the electric lighting in Rossland, in both arc and incandescent services, is rendered from alternating circuits, and indeed the only use to which direct currents are put in the Kootenay plant is for the excitation of generators and synchronous motors. The electric lighting load reaches a maximum of nearly 400 horse power. Enclosed alternating arc lamps are used exclusively, and these are burned from the 110-volt

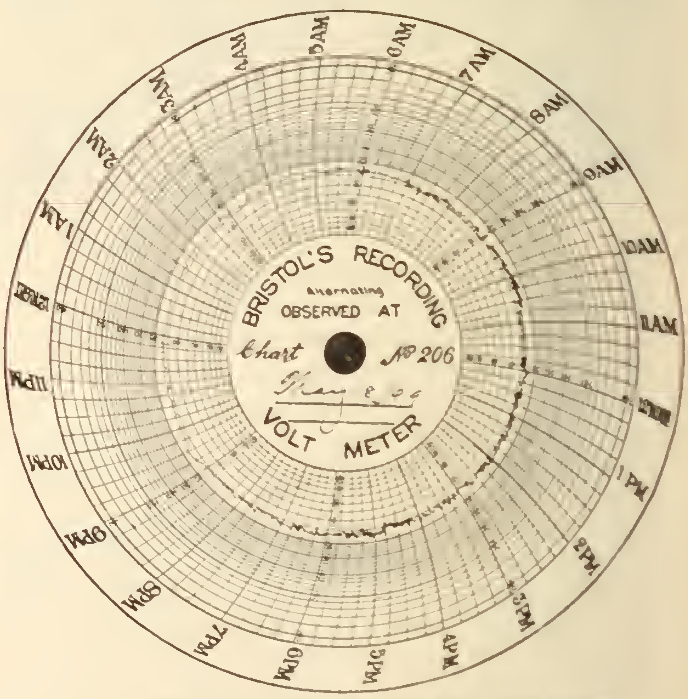


Fig. 6.—Typical Chart of Voltage Regulation.

commercial circuits. The ultimate distribution is on the Edison three-wire system through the use of type H transformers, taking either 1,400 or 2,080 volts on the primary and delivering 230 volts across the outsides of three-wire service. The utmost care has been exercised in preserving the balance on the three-wire distribution circuits as well as in balancing the primaries of the commercial transformers on the three-wire, three-phase, 2,200-volt circuits, and this balancing has been carried out so well that it has never been observed that the phases of the 2,200-volt circuits have been more than 10 amperes out of balance.

As stated heretofore, the principal interest in the Kootenay-Rossland transmission centers in its applica-

tion of electric power for mining and milling purposes, the most notable installations being in the properties of the War Eagle Mining and Development Company, the British Columbia Bullion Extracting Company, the British American Corporation, and the Gertrude, Big Three and Iron Mask mines. These six properties alone consume about seventeen hundred horse power in the operation of hoists, compressors, crushers, conveyors, ventilating blowers and in electrolytic work. The bulk of this power is delivered by induction motors, for, as a general rule, synchronous motors have been applied only to the driving of compressors.

Fig. 7 gives a general view of the controller of the War Eagle hoist, which will be seen to be a standard General Electric induction motor. It is a three-phase equipment operated at 2,300 volts, has twenty-four poles and delivers three hundred horse-power at three hundred revolutions per minute. Its technical designation is, therefore, "I 24-300-300 form A." The rotor shaft is geared to a Ledgerwood type double drum hoist through double reduction gearing, having a ratio of reduction of 300 to 40. The War Eagle shaft is at present down a little beyond the 600-foot level and the maximum load raised amounts to eight tons, including the load, cage and rope, the speed being 720 feet per minute for this load.

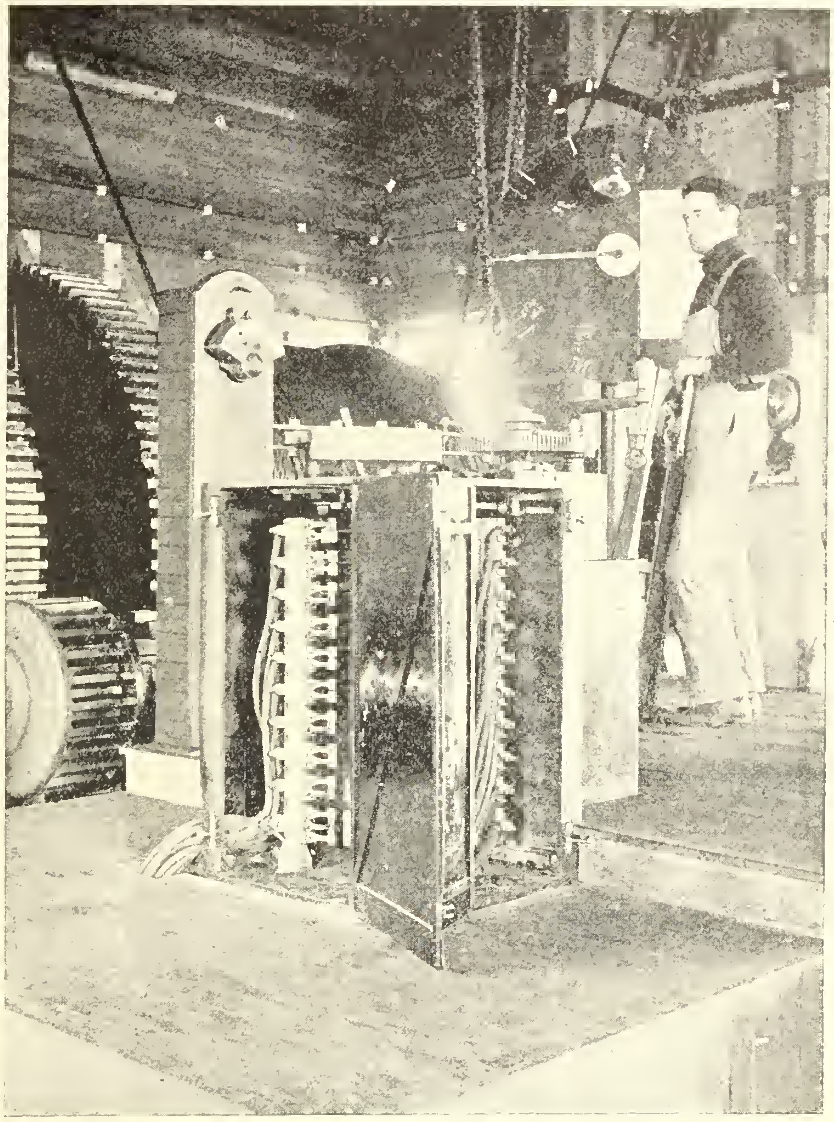


Fig. 7.—View of Controller for Induction Motor for War Eagle Mine.

Interest, of course, centres in the method of speed control, each technical detail of which is fully shown in the accompanying illustrations. Secondary control is used exclusively; that is, no effort whatever is made to control the primary current, while the secondary current, or that induced in the rotor circuit, is varied by the introduction of external resistance. The controller proper, shown in Fig. 7, is a duplex one, inasmuch as the movement of the controller handle manipulates both the primary and secondary circuits of the motor, the former for making, breaking and reversing, and the latter for the control of the variable external resistance. The controller on the high tension or stator side operates in a bath of mineral oil. The secondary windings are led to three collector rings placed on the shaft with the rotor, and upon these rings bear carbon brushes which cover about 90 degrees of the surface of the rings, this being a necessary procedure because of the heavy ampereage to be taken off. The maximum secondary electromotive force obtained is in the neighborhood of seventy volts. From the rotor brushes the current is carried to the low tension side of the controller, through which resistance may be cut in or out of the rotor windings in ten steps. The resistance consists of cast iron grids arranged upon a large slate resistance board as shown in Figs. 8 and 9. With the maximum load of eight tons gross at a speed of 720 feet per minute the current reaches a maximum of 110 amperes per phase, dropping back to 90 amperes as the load decreases by reason of the cage nearing the surface. With a load of men the maximum current is 70 amperes per phase.

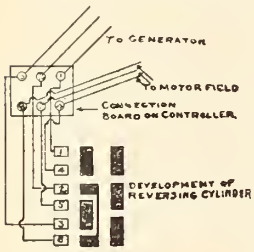
Fig. 8.—Front View of External Resistance Board.

The principle under which variable speed is attained in the operation of this induction motor is found in the fact that while in the synchronous motor exact synchronism between the motor and the generator must always be maintained, yet the induction motor is so constituted as to be nearly independent of any magnetic slippage that may exist between its stator and rotor. When under full speed the motor is practically in synchronism with the generator, but with the generator speed constant a variable speed in the motor is best

attained by the introduction of methods that will provide variable slippage as desired, for the greater the slippage the slower will be the speed of the rotor. The equipment at the War Eagle hoist is so controlled that the speed of the motor may be varied from forty revolutions or less per minute to its full speed of three hundred revolutions.

It will be seen that the high and low tension controllers are geared together, this being done in such a manner that both are actuated at proper intervals by the manipulation of a single controller handle. The only function of the electrical equipment is that of hoisting, for as the cages are balanced one against the other, it is the rule that power is applied for either direction of rotation. Braking is done through the application of band brakes by means of the hand levers shown in the illustration.

The subjoined diagram of circuit connections shows



the development of the reversing cylinder as applied to the high tension controller. The head board of this controller has six terminal lugs, those numbered 1, 2 and 3 being for the service leads, while those numbered 4, 5 and 6 are carried to the motor. The controller applies the full line potential of 2,300 volts to the stator, and it serves not only as a make and break switch but also as a pole changer for reversing. The short circuiting of terminals 1 to 4, 2 to 6, and 5 to 3, causes a given direction of rotation, while the short circuiting of terminals 1 to 4, 2 to 5, and 3 to 6 causes an opposite direction of rotation, all as shown in the attached circuit diagram. Mineral seal or any high grade transformer oil may be used for the bath for this high tension controller, which gives perfect satisfaction in operation.

The connections of the circuits by means of which external resistance may be cut in and out of circuit with the rotor windings through the low tension controller are outlined in Fig. 10, and in Fig. 13 is given the assembly diagram of the stationary cast iron resistance as mounted on the slate resistance board shown in front and back views in Figs. 8 and 9. It must be understood that the terminals at the bottom of the slate panels appearing in the upper portion of Fig. 10 are the same as those shown at the bottom of Fig. 13. The

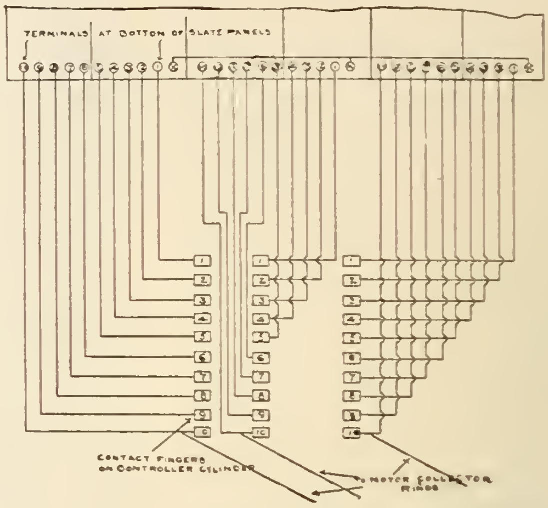


Fig. 10.—Connections of Induction Hoist Motor and Controller.

resistance strips shown so clearly in Fig. 9 consist of cast iron grids, each in three waves, having a sectional area of about 1/8 by 5/8 inches and which have a running length of about sixty inches. These grids stand out from the board about 14 inches and they are in 23 vertical rows by 18 horizontal ones, and while the average cross section is as given, it varies slightly above and below that figure according to the ampereage carried.

Reverting to the scheme of low tension controller and

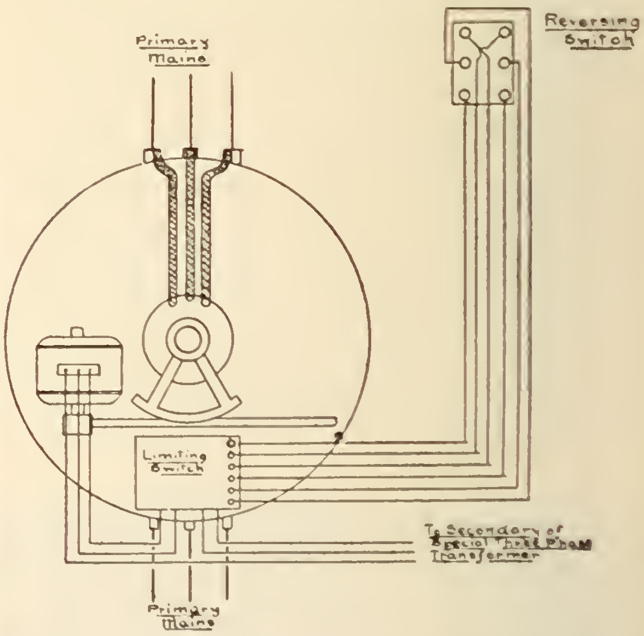


Fig. 11.—Connections of Induction Regulator.

resistance switchboard connections outlined in Fig. 10, the leads from the slip rings on the shaft of the motor are carried to three sets of contact plates placed on the controller cylinder in ordinary arrangement, and upon these contact plates play the contact fingers which carry current successively to the resistance. Three posts are erected in the controller, each of which carries a set of ten contact fingers, and two of the sets are shown in Fig. 7. As stated, the maximum potential broken by the low tension controller is about seventy volts and the sparking is inconsequential.

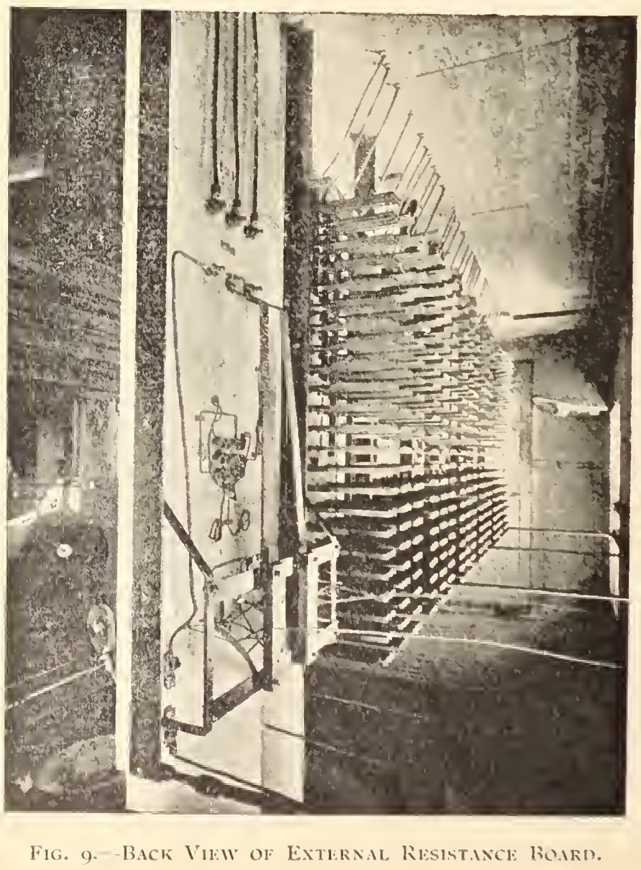


Fig. 9.—Back View of External Resistance Board.

One who is interested could spend hours in watching the operation of this hoist. It is easily handled by one man, who finds himself with much less to do than has the motorman on an electric railway. In fact, the operation of the War Eagle hoist finds greater resemblance to street railway practice than one would imagine. The controller is manipulated with the same ease and celerity that attends the handling of a street railway controller, and it is more simple than the modern street railway controller in one regard, and that is the fact that reversal is accomplished by the moving of the controller handle in a reverse direction rather than in the throwing of a special lever. At times when men are on the cage the hoist is "kicked" along by the momentary application of power to the motor, which enables it to be run at much slower speed even than that possible with the controller on the first notch. At other times, in hoisting ore, a dead load of five tons of which is almost always carried, the motor will be brought up to speed in a very few seconds and this without any abnornal inrush of current, for, as stated, during the writer's observations of the operation of the equipment under all conditions of service, the motor intake did not exceed 110 amperes per phase. The motor has an efficiency of 92 per cent. and a full load power factor of 88 per cent., while at the slowest speed the power factor may drop to possibly between sixty and seventy per cent., but of this last statement no direct data is available at present. Current for the operation of the entire War Eagle equipment is sold by contract, i.e., on flat rates.

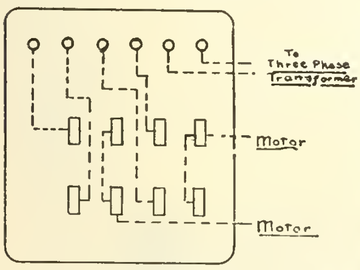


FIG. 12.—CONNECTIONS OF LIMITING SWITCH.

The next feature of interest in the electrical installation at the War Eagle mine is found in the 300-kilowatt synchronous motor operating the 40-drill compressor illustrated in Fig. 15. Three-phase current at 2,300 volts is applied to this motor, which runs at 200 revolutions per minute. It is of the revolving armature type, has thirty-six poles, and, consequently, bears the designation "A P 36-300-200." A General Electric multipolar exciter, not shown in the illustration, is driven from a large pulley on the free end of the motor shaft, and this exciter has an output of nine kilowatts at 125 volts when operated at 1,450 revolutions per minute. The compressor, which is of a double duplex type, is driven through independent ropes applied direct as shown in the illustration.

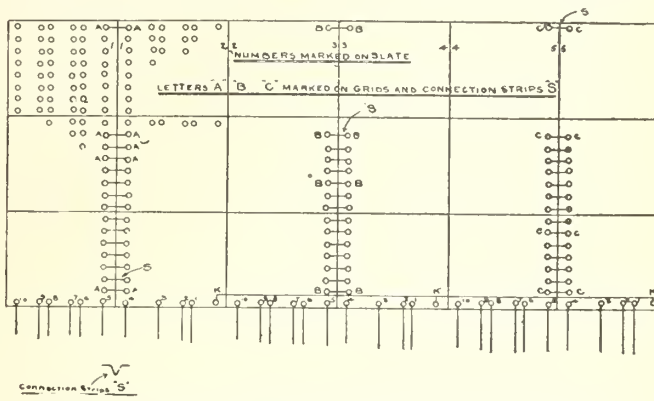


FIG. 13.—ASSEMBLY DIAGRAM OF STATIONARY CAST IRON RESISTANCE.

The method originally installed for starting the synchronous motor is also shown in the illustration given, and it consisted of a thirty horse power induction motor belted to a counter shaft through a friction clutch, this shaft carrying a spur gear by means of which the armature was brought up to speed. It can not be said that this equipment has been satisfactory, although it is in practical operation. The difficulties in its use rest, first, in the fact that in bringing the armature up to synchronism the compressor must, as well, be brought up to speed ; and second, the 30 horse power motor is too small for the duty required. It takes most exactly eight minutes to bring the motor up to synchronism, in

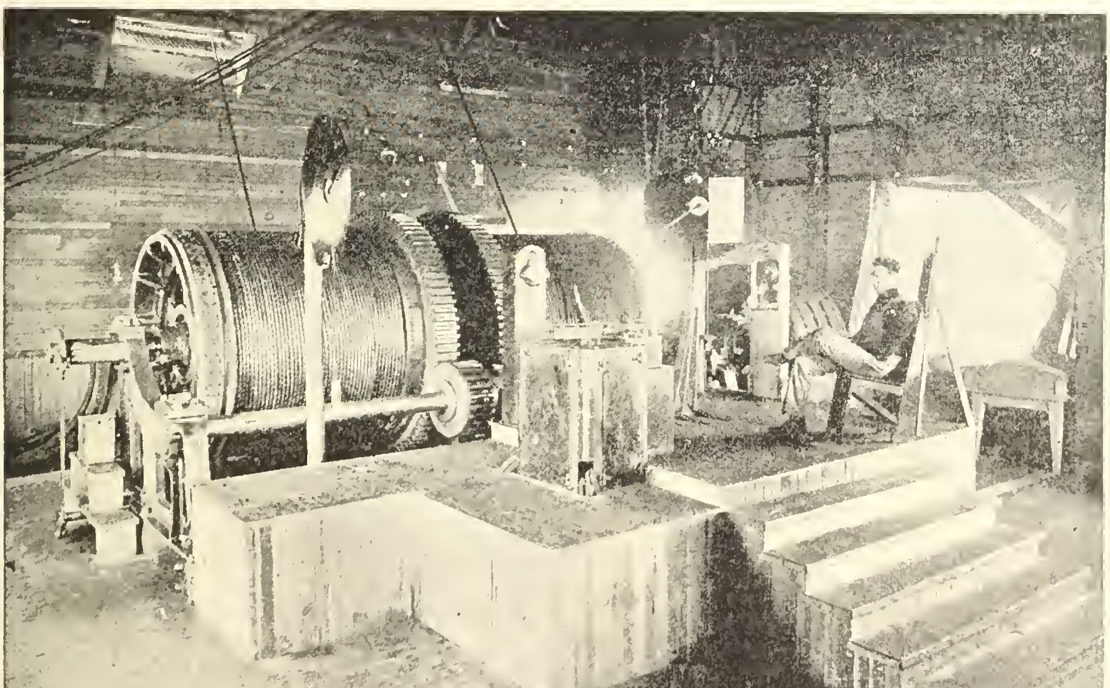


FIG. 14.—GENERAL VIEW OF INDUCTION HOISTS AT WAR EAGLE MINE.

doing which the 30 horse power induction motor delivers from 120 to 130 horse power, and, incidentally, has its temperature raised to a point somewhere above that conducive to a ripe old age. Although the small motor was still in service at the time of the writer's visit to the mine, it was shortly to be replaced by one having more than double its capacity. It should be stated in justice to the engineer of the Kootenay company that the starting device here discussed was not of his design or sanction. With the exception of the time consumed in starting, the equipment gives the best of satisfaction. A number of small motors ranging up to 20 horse power in capacity are used in and about the War Eagle mine for ventilating purposes, driving conveyors, etc., and all these motors are of the induction type except that on the compressor.

At the Iron Mast mine is a 75-kilowatt "S.K.C." synchronous motor, made by the Royal Electric Company, of Montreal. It is a two-phase motor, with connections altered for three-phase service, and is started through an "S.K.C." induction motor and water rheostat, both of which appear in the illustration shown in Fig. 16. The water rheostat consists of three fan-shaped blades plunged edgewise into a three-compartment tank of water, thus enabling the water resistance cut into each leg of the three-phase circuit to be varied according to the depth of immersion. The 75-kilowatt motor is belted to a jack shaft in the manner shown, which drives two double-acting compressors having a combined capacity of ten drills. This is the only Stanley equipment on the West Kootenay circuit, and its service is most reliable.

In the Big Three mine is a 75-kilowatt General Electric synchronous motor, driving a seven-drill compressor in the manner shown in Fig. 17, while at the Gertrude mine is a 50 horse power induction motor operating a hoist. The British Columbia Bullion Extraction Company has one 50 horse power induction motor driving a rock breaker, and one 75-kilowatt synchronous motor operating all machinery about the mine, including generators for electrolytic work.

These motors, as well as all others referred to hereafter, are of Canadian General Electric manufacture. In the properties of the British-American corporation are four 150 horse power induction motors, each operating a double drum hoist through equipments which are in every way similar to those at the War Eagle mine. All underground work in and about Rossland is operated at 220 volts. Aside from mining work, the principal power installation is that of the general machine shop of Cunliffe & Ablett, where a 50 horse power induction motor is installed. There are many small motors ranging from one to five horse power in size for furnishing of light power in different industries in Rossland.

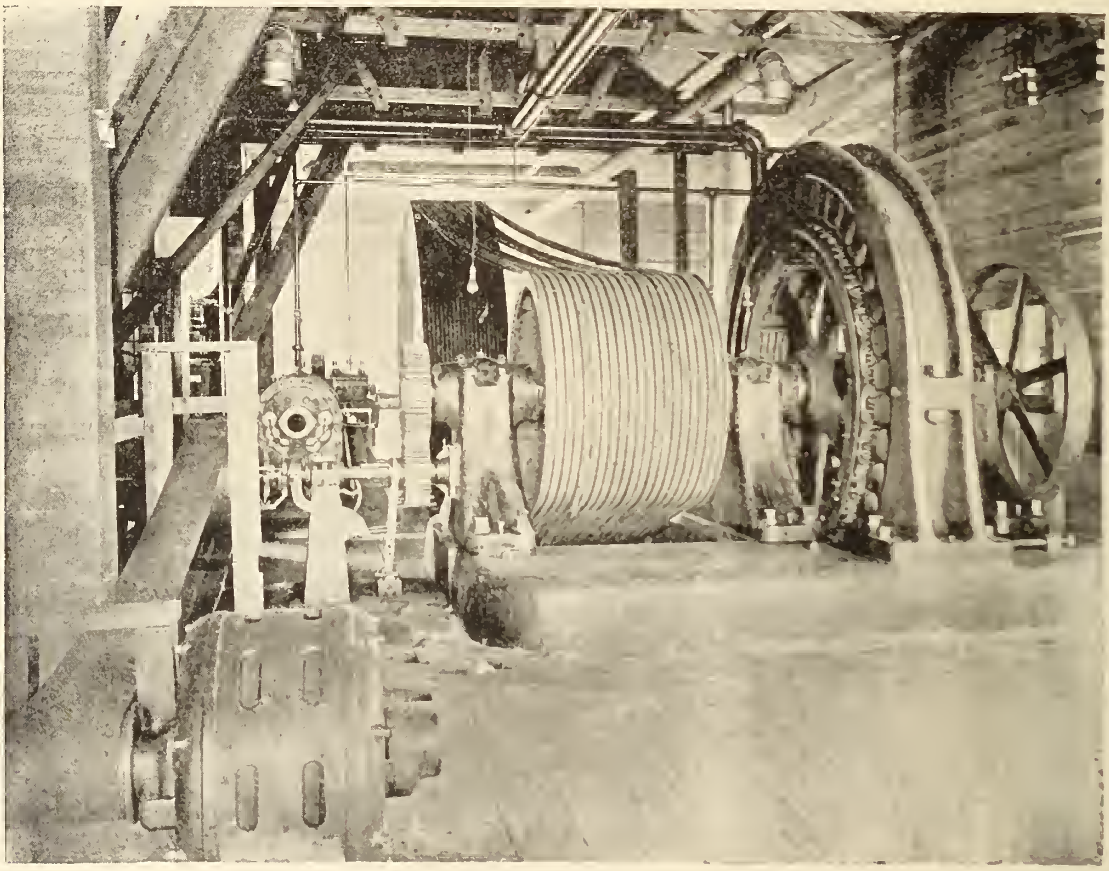


Fig. 15.—View of 400-h.p. Synchronous Motor, Driving 40-Drill Compressor at War Eagle Mine.

One of the most interesting points to be brought out by the Kootenay-Rossland transmission is the demonstration of the fact that the operation of synchronous and induction motors in large units for the driving of hoists and compressors will not necessarily create serious disturbance in the voltage of the distribution circuits, provided high voltage, ample fly-wheel effect and capacity prevails. During daylight the power and lighting circuits are operated in parallel, although they are separated and operated independently from the power house by night. The War Eagle hoist, however, is operated on an independent circuit by day, but at night it is cut into the power circuit at the Rossland sub-station. The result of this arrangement is shown in the reproduction of the recording voltmeter chart shown in Fig. 6, which is that of the lighting circuit. From 6:45 p.m. to 5:00 a.m. the chart shows the regulation of the lighting circuit when

on an independent line from the power house. At 5:00 a.m. the War Eagle hoist is taken from the power circuit and put on an independant line to the power house, and the remaining power load is coupled in with the lighting load and carried on the second line to the power house. The voltmeter curve, therefore, from 5:00 a.m. to 6:45 p.m., shows the regulation of the plant when all power with the exception of that for the War Eagle hoist is in parallel with the day lighting load. The chart given is that for an ordinary day, and, indeed, the charts run so evenly from day to day that each almost duplicates the other. The day in question there were in operation from 5:00 a.m. to 6:45 p.m. three 100 horse power syochronous motors with an average load of 280 horse power on compressor work; five 50 horse power induction motors with an average load of 210 horse power on the same, three of which were on hoists; three 30 horse power induction motors with an average load of 76 horse power, and one 40 horse power induction motor carrying an average load of 32 horse power. The lighting load consisted of 300 horse power, which is high in proportion to the night lighting load because of the heavy 24-hour load carried. The repoit from the generating station for the same day shows that the variation reached 108 amperes at 110 volts, or an approximate variation of 205 horse power, considering which the regulation is remarkably good. The secret of this is stated to lie in always maintaining a high voltage in relation to the motor ratings, with ample generator and wheel capacity.

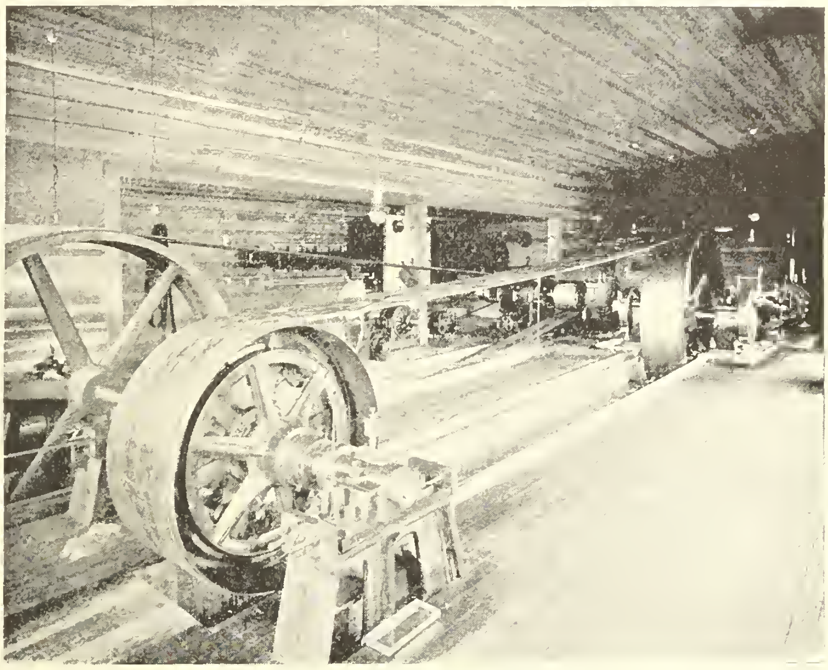


Fig. 16.—Stanley 100 Horse Power Synchronous Motor, Driving 10-Drill Compressor at the Iron Mask Mine.

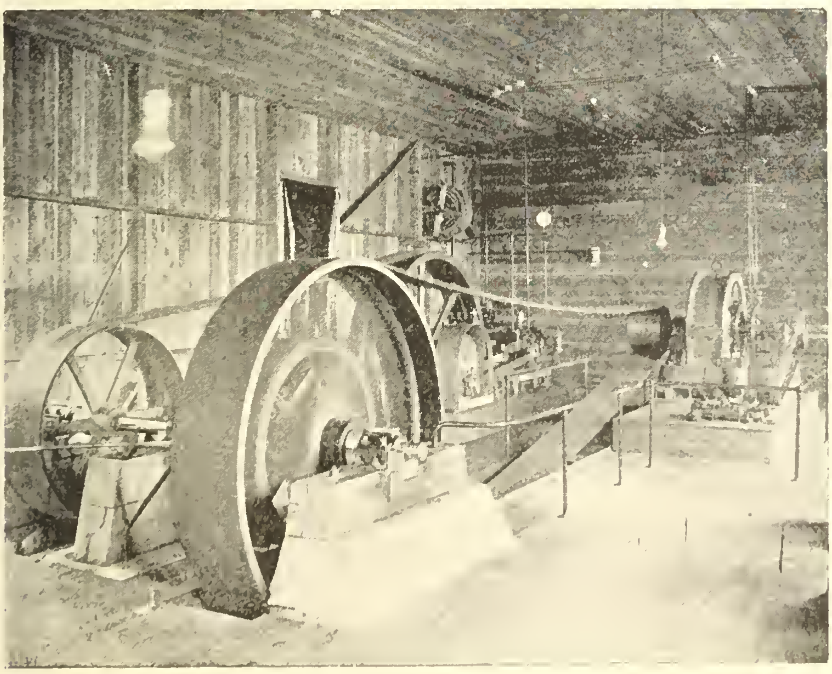


Fig. 17.—100 Horse Power Synchronous Motor, Driving Seven-Drill Compressor at the Big Three Mine.

The construction of electric railways in Chatham and Sarnia, Ont., is being advocated.

THE CANADIAN ELECTRICAL ASSOCIATION.

Under the direction of the new president, Mr. A. A. Dion, a meeting of the Executive of the above Association was held at the Russell House, Ottawa, on September 14th. Besides closing up satistactorily all matters in connection with the last annual convention, the committee discussed at some length the work which should engage the attention of the Association during the present Association year. This work has been allotted to various committees, which will be called together at an early date.

The Committee on Meters has been requested to devise some satisfactory scheme for the re-inspection of meters which will entail less expense upon the lighting companies than is imposed by the existing regulations. The Government Inspection Department is understood to be desirous of meeting the wishes of the companies in this regard, if a satisfactory scheme can be propounded. The view urged by the Association, as representing the companies, is that the present inspection fees should cover the cost of re-inspection during the period for which the meters are sealed, or that if a second fee be necessary, it should be for a nominal amount. Experience is said to have demonstrated that watt meters do not accumulate as much dust and consequently are less liable to disarrangement with the alternating as with the direct current.

A public meeting was held in the village of Erin, Ont., recently to discuss the question of installing an electric plant for lighting the streets. A committee was appointed to ascertain the cost of lighting in other places.

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EDITOR'S ANNOUNCEMENTS.

Correspondence is invited upon all topics legitimately coming within the scope of his journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

Steam Ploughing. AN illustration of the growing application of steam power for agricultural purposes was given last month at Morden, Manitoba, where a test was made by the Canadian Pacific Railway Company of a steam plough. The machine moved at a speed of one and one-quarter miles per hour, and dragged after it a gang of ten ploughs, which turned over a width of twelve feet of earth, of the depth of four inches. The fuel used was the herbage which had grown on the prairie common to the western country, and which had been cut down a few days previously. We are told that the fly-wheel moved at the speed of 203 revolutions per minute, and the driving wheel of the machine at four and one-half revolutions. At the speed at which the test was made, the ploughing done in one day would be about 20 acres. As the price paid for ploughing in the North-West is said to be about three dollars per acre, it would seem that from the point of economy the steam plough is a success. That they will come into more general use is almost a certainty. In Germany, for instance, steam ploughing is said to be very largely adopted.

Fixed vs. Moveable Coils. IN dynamo design, a debatable question at the present time is the relative superiority of moving or fixed coils. Elsewhere in this issue Mr. W. A. Johnson presents arguments in favor of the type of machine with stationary wire, contending that the two coil inductor alternator overcomes the objections of bad regulation and over-heating which may be made against the single coil machine. In European countries this question is also receiving some attention, and it has by no means been decided which method of construction possesses the greater merit. Although the idea of the inductor alternator was conceived twelve years ago, it is only recently that a machine of this pattern became one of the standard types of the Brush Company. They have now been installed in some of the largest electrical works, and are said to be giving satisfaction. On the other hand, a correspondent writes to a British exchange that there is a tendency on the part of Swiss dynamo makers to return to the revolving coil machine. We are not told, however, whether or not more than one field has been employed.

The Storage Battery. DR. N. H. Edgerton, of Philadelphia, is building a factory in the city of Hamilton, Ontario, for the manufacture, on a somewhat extensive scale, of the high tension battery of which he is the inventor. Considering the limited demand as yet in Canada for the storage battery, this is a strong indication of the faith of Dr. Edgerton in the future of storage batteries generally and of his invention in particular. As it is said to be the intention to employ some fifty workmen, the question of a market for the output of the manufactory suggests itself. This is in part answered by the fact that the Cataract Power Company, which has already secured control of several electric railways in and around Hamilton and contemplate building other new roads, are very likely to install a storage battery system as an auxiliary to their railway power plant. From this it may be judged that the promoters of this manufactory anticipate a much greater use of the storage battery for railway purposes, not for direct operation, for which they have not been found satisfac-

tory, but as an auxiliary plant. If the storage battery should be employed in this manner by the Cataract Power Company and be found satisfactory, it will undoubtedly result in other companies following in their footsteps, and will give encouragement to the storage battery industry in Canada.

Extension of Canadian Telegraph System. THE Dominion government is about to undertake the construction of two quite important extensions to its telegraph system, both of which will involve rather uncommon engineering features. One of these is a line from Lake Bennett to Dawson city, in the Yukon district, for which three hundred and thirty thousand pounds, or one hundred and sixty-five tons, of iron wire will be required. The second is the extension of the Gulf of St. Lawrence telegraph system from Big Roumaine, Quebec, to Chateau Bay, Labrador, opposite Belle Isle, a distance of 315 miles, and which has been frequently asked for by the shipping interests. In connection with the latter extension, it is not improbable that wireless telegraphy will be employed to communicate between Chateau Bay, on the Labrador coast, and Belle Isle. It is said that the experts are as yet undecided as to how the connection will be made. The laying of a cable would be the most simple method, but it is feared that it might be broken by the grounding of icebergs in this narrow strait. About the only alternative, therefore, seems to be the adoption of a system of wireless telegraphy, and this course is understood to be under consideration. The demonstrations that have been made of this system would seem to place its practicability beyond question, and its adoption in Canada to a greater or less extent may be expected to follow in the near future.

Pumping Water by Electricity. THE Cataract Power Company have made another proposition to the city council of Hamilton to pump the water supply of the city by means of electricity, instead of steam, now employed. The revised offer is said to be more favorable than the previous one, and there is a probability that eventually satisfactory terms for performing the service will be reached. The Cataract Power Company contends that by the introduction of electric power a considerable saving in cost of operation can be effected. The pumping of water by electricity, not a new idea, opens up another field for the central station manager to exploit in his search for a market for the output of his station. Where the water supply is pumped by electricity, it may be found expedient by some cities and towns to adopt a system of water purification by means of the electric current. We observe that in St. Louis such a method has been adopted with satisfactory results. The system consists in admitting the water to be purified into a tank divided into small compartments. In each of the latter a pair of electrodes are located, the positive being attached to the bottom of the compartment, while the negative floats upon the surface of the liquid. As these receptacles are presumably non-conductors of electricity, when the current is turned on it naturally passes through the water from the positive to the negative electrode, and by decomposing it liberates hydrogen, which escapes to the surface, carrying with it all foreign matter and impurities. In Paris, France, the Tindal system is in use. This consists in forcing air that has been subjected to the action of a high tension elecric current, and thereby ozonized. into the water to be purified. The cost is given as .028 of a cent to sterilize one cubic yard of water, which certainly seems very reasonable.

The Record of Acetylene. THE Canadian Manufacturer, apparently with the object of securing the favor and incidentally the advertisements of the manufacturers of acetylene gas machines, charged this journal with having misrepresented the extent of the development of acetylene lighting by publishing statistics compiled by the Canadian Electrical Association. Our answer showed clearly that no responsibility attached to us for the correctness or otherwise of these statistics, which were published as a part of the proceedings of the Canadian Electrical Association convention. The Manufacturer, evading entirely this, the main point, in our reply, returns to the attack in this manner : "Our esteemed contemporary gives itself away, for in the very letter that it alludes to from a manufacturer of acetylene gas machinery, data is given that disproves the assertion that there are only 155 machines in use in Canada. If the Electrical News desires to verify its unverified statement, we will have pleasure in giving it the names of a few Canadian concerns whose annual output each is in excess of the gross number mentioned in the statement alluded to." As to the correctness or otherwise of the statistics published, the editor of The Manufacturer should have addressed himself to the Canadian Electrical Association, under whose direction the figures were compiled and given to the public. Incidentally it might be mentioned that the editor of The Manufacturer "gives himself away" when he alludes to data given in the letter of a manufacturer of acetylene apparatus, mentioned in our previous reply, which letter, through an oversight, was not published in our September number.

LIQUID AIR.

PRIOR to 1887, says the Engineer, air was thought to be a permanent or incondensable gas, but it was liquefied simultaneously by Messrs. Pictet and Caillete at that time, though at an enormous expense. About 200 years ago the lowest temperature thought to be obtainable was produced by a mixture of snow and ice, and was used by Fahrenheit in establishing a zero for his thermometric scale. Since that time scientists have reached a temperature some 400 degrees below the lowest point ever reached by Fahrenheit. Of the three known methods for producing cold, the first, i.e., by the rapid solution of a solid was used entirely up to 1820 and yielded a temperature of 50 degrees below zero centrigrade. The other two methods are the rapid evaporation of a volatile liquid and the rapid expansion of a cooled and compressed gas. By a combination of pressure and refrigeration, Faraday in 1823 liquefied all except six of the existing gases, but it was not until 1869 that it was discovered that these gases must first be cooled to a critical temperature. By subjecting hydrogen to an enormous pressure and at the same time lowering its temperature it was found possible to liquefy it. Hydrogen has a critical temperature only 33 degrees C. above the absolute zero of temperature. From the experiments performed, the conclusion was drawn that solids, liquids, and gases were but different forms of matter through which any substance could be made to pass by the addition or withdrawal of heat and pressure.

THE DIRECT CURRENT MOTOR.*

By L. A. Herdt, Ma. E., E.E.

Dynamo electric machines belong to the class of machines which are called reversible. This does not mean that they can be run backwards, but that the transformation of energy which goes on in the machine is reversible.

If we apply mechanical energy to a dynamo so as to make it rotate, it will generate a current of electricity. This current we can send to a distance through conductors, let it enter a machine, another dynamo, and this machine will start to rotate and convert the current or electrical energy supplied to it into mechanical work—the motion of visible masses of matter. In this accomplishment we started out with mechanical energy, and come back to it far from its first application. Electricity in the transformation has only been a link, a means of transmitting the power. Motion is necessary to produce the current, and the dynamo or motor is merely a device for transforming what is called energy from one form to another.

A motor is therefore the same machine as a dynamo, or a dynamo to which a current is supplied. Therefore, in studying the inner working of a motor, we must deal with exactly the same principles that we find at work in dynamos. The main parts which are to be considered in a dynamo are the field magnets and the armature. The field magnets, which produce the magnetic field, are usually stationary; the armature, the part in which the currents are induced, revolves.

A commutator is also required, either to carry the current generated in the conductors of the armature to the line, as in a dynamo, or to conduct the current from the line to the conductors on the armature, in the case of a motor.

If a conductor forming a loop is moved across a magnetic field, a current will flow in this conductor; this current will be generated as long as the motion lasts, and the moment that it stops the current will vanish; also, if a conductor carrying a current is placed in a magnetic field in a plane at right angles to the magnetic lines, it experiences a force urging it to move in that plane. The motion will last as long as the current is flowing in the conductor and as the conductor is still in the field. Motion is therefore necessary to produce the electric current, and the electric current will in turn produce motion.

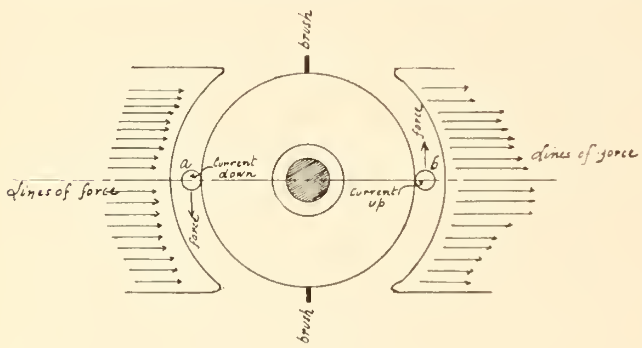

Fig. 1.

The armature, as found in dynamos, is simply a collection of loops of wire so arranged that each conductor in its rotation between the field magnets is carried past these field magnets, and current is generated in these conductors. In a motor, the conductors carrying current and placed in a magnetic field are subjected to a force which, as will be presently explained, produces a rotation of the armature.

Fig. 1 shows a section of an armature and pole pieces of a dynamo. This section is in a plane at right angles to the shaft; a and b are two conductors forming a part of the same loop, the currents in these being in opposite directions. It will be found that conductor (a) will be subjected to a force acting downwards, while the force on (b) will be upwards, the effect of these two forces, as will readily be seen, being to turn the armature about its axis. If any number of conductors are arranged on the surface of this armature, the forces acting on these conductors will be all downwards on one side of the brush plane and upwards on the other side. These forces, acting on the conductors at a certain distance from the axis of the shaft, results in a twist, so that the shaft will be turned. If we were to rotate by hand the armature of a small dynamo, we would find that as long as the dynamo is not made to generate any current, the resistance to turning the armature would be very small. As a matter of fact, this resistance is that simply due to the friction of the shaft in its bearings, and the friction due to the pressure of the brushes on the commutator. But if we should now close the circuit of the dynamo so that the machine will generate a current, the force that we shall have to exert to keep the machine rotating is many times greater, for since the conductors are now carrying current, the force which we find acting between magnetic fields and conductors carrying current is acting against the imparted motion of the dynamo.

In a motor this force is the one which causes the machine to rotate, and is therefore acting in the direction of rotation.

It seems puzzling to the mind of the unacquainted observer how it is that so much force has to be exerted to drive a dynamo under load; the armature revolves between the polar pieces quite freely, the mechanical friction can absorb but very little power, then what becomes of the surplus power which is mechanically imparted to the machine. The answer is, that there is a force which the magnetic field exerts on the conductors of the armature since they now carry current; this force or drag opposes the rotation, the larger the current in the armature the greater this drag and the more the power which is required to keep the machine revolving.

In a motor this drag is the driving force, and is the one which produces the rotation.

THE STARTING OF ELECTRIC MOTORS.

In starting an electric motor from a stand-still, it will be found necessary to introduce a resistance in the armature circuit of the motor, this resistance to govern the current and reduce it to any desired flow. At starting, or when the motor is running slowly, the current has to go through a resistance box called starting box, and then through the conductors of the armature; the field coils are either connected directly to the line as in shunt-wound motors, or in series with the starting box and armature as in series-wound motors. The current strength is therefore given by the ratio of the electro-motive force of the line and the total resistance introduced in the circuit. In order to speed up the motor, the resistance of the starting box is gradually taken out, until the motor is placed directly on the line and is then running at its rated speed.

Without this resistance at the start, the current that would go through the motor would probably be excessive and prove injurious to the insulation of the armature; besides it would not be doing useful work, for useful work is only done when the armature revolves. The current at start should be large enough to start the rotation, but not large enough to injure the motor.

If the resistance in circuit is now cut out gradually the motor will speed up, and it will be found that the faster the motor runs the weaker the current becomes. This is due to a generating action taking place in the motor itself on account of its speed, in fact the motor by its rotation is now working as a dynamo on its own account and tends to generate a current in the circuit in the opposite direction to that which is driving it. As the production of current is due to an electro-motive force, this generating action taking place in the motor will be found to be due to an electro-motive force acting as soon as the machine is rotating. This electro-motive force, which is called a counter electro-motive force, varies with the speed, that is, increases or decreases with the speed. The current now does not depend on the electrical resistance of the circuit alone, but is checked by this electro-motive force of reaction which is working against the electro-motive force of the line. Therefore, whereas in a generator there is only one electro-motive force acting, in a motor there must always be two as soon as the machine is developing work, that is, as soon as the machine is rotating.

The electrical energy supplied to a motor is measured by the product of the voltage on the line into the current flowing; this product is expressed in watts, and if divided by 746, will give the electrical horse power delivered to the motor. This energy, usually called the electrical input, is, however, not wholly converted into useful work, and only a portion of this (happily a large one) will be available on the shaft.

The energy supplied is expended in two ways, in heating the circuit and in doing work. The expenditure of energy in the form of heat is the product of the resistance of the circuit into the square of the current. This product is expressed in watts, and may be termed heat watts. This amount of power is lost and simply heats up the machine; to reduce this loss will be to make the resistance of the armature as small as possible. The difference between the total watts supplied to the motor and the heat watts may be called the mechanical watts, that is, it is this part of the total energy which will be transformed in the machine from

* Abstract of a lecture delivered before the Y.M.C.A. Electrical Club, Montreal, by L. A. Herdt, Ma. E., E.E., Lecturer in Electrical Engineering at McGill University.

electrical to mechanical energy. These mechanical watts, however, may be divided into two, those which are utilized in doing useful work, and those which are required to overcome the internal resistance to motion.

For example, in all motors a certain amount of work is required to overcome the friction of the bearings, the friction of the brushes on the commutator, the resistance of the air, and such effects known as hysteresis and eddy currents. The energy required to overcome these must evidently be drawn from the supply, and amounts to a certain loss, and the aim of the designer is to reduce these to a small value. The rest of the mechanical watts, usually called the useful watts, are available for useful work ; that is, the energy available on the shaft of the motor.

"En resume," we see that, of the electrical horse power delivered to a motor, only the useful mechanical watts are available for doing work ; the ratio of these to the electrical input in watts is called the efficiency of the motor. The electrical input is easily measured by means of an amperemeter and of a volt meter.

The mechanical output can be measured in different ways, one method being by a brake, such brake to be in the form of a prony brake, which is well-known. This brake consists in clamping on the pulley of the motor a pair of wooden jaws which absorb the power. Sometimes it consists of a rope passing over the pulley, the pull on the rope being measured by means of a scale. If p is the pull in pounds on this rope, and r the radius of the pulley over which the rope is passed, the twist on the shaft retarding the motion is equal to pr. If the pulley revolves at a speed of n revolutions per second, the speed of the periphery of the pulley is equal to $2\pi rn$. Now, the work is the product of the force by the velocity at the circumference, therefore the work absorbed in foot pounds by the brake $= p \times 2\pi rn$. Now, 550 foot pounds per second equals one horse power, therefore the horse power absorbed by the brake is equal to $\frac{2\pi rnp}{550}$. This measures the output of the motor.

INHERENT REGULATION IN INDUCTOR ALTERNATORS.

By W. A. Johnson.

It should not be necessary to call the attention of the buyers and users of electric machinery to the great desirability of having practically perfect regulation in any dynamo, but this important feature is very often overlooked. By perfect regulation is meant that all ordinary changes in load, from the throwing on or off of lamps, should not cause change in pressure of more than 2 per cent. The usual guarantee of engine builders at the best is but a regulation of two per cent., consequently the dynamo builder is limited to this percentage, as the regulation of dynamo can be no better than the constancy of the speed, as governed by the engine or water-wheel, allows of. It is well known that direct current dynamos are turned out by makers of high grade machines that will give a regulation of 2 per cent., but until recently no inductor alternator has been able to show anywhere near the result.

Good regulation means longer life of lamps, greater satisfaction to the customers, less attention to controlling rheostat, and it generally means a cool running dynamo (unless the dynamo is overloaded). Not only is this true of direct current dynamos, but to much greater extent with alternating current can the greater advantages of perfect regulation be claimed as the most essential point to consider in the selection of a machine, as without proper design the false currents generated in the iron of the machine through lack of magnetic balance necessarily result in excessive heat, bad regulation and low efficiency, and especially is this true in the inductor type of dynamo. The principal reason why one or two of the older manufacturers of alternating dynamos have adhered to machines having moving wire instead of adopting the inductor type, is that most inductor dynamos on the market have extremely bad regulation, and necessarily, through hysteresis losses, low efficiency. Therefore, one or two of the larger manufacturers are still adhering to the old type of moving wire machines, obtaining regulation through complicated composite windings, rectifiers, etc., and of course retaining all the attendant disadvantages of such construction. The mechanical and commercial advantages of the inductor dynamos are so obvious, however, that a machine overcoming the objections mentioned should meet with the approval of all users. It is possible to design an inductor alternator of such construction that perfect inherent regulation within two per cent. can be obtained for all ordinary changes in load, such as throwing on or off the lamps in a theatre, church or any large building, say 250 lamps on a 1000 light machine, and proportionally on larger sizes. In fact, fully one-third of the capacity of a machine has been cut off with a momentary fluctuation of but one and one-half volts, the needle setting back in a few seconds to standard voltage.

This is far closer than has been obtained before with inductor alternators, and absolutely does away with constant attention to the rheostat (except for change in speed) after the dynamo and line is at working temperature. This is a stronger claim than can be made for the composite wound machine under the usual working conditions. Now, how can this close inherent regulation be obtained? Only in a machine having magnetic symmetry.

This is the key note of dynamo design, and if lacking in an inductor alternator, then through the irregular action of the magnetic flux the different parts of the iron frame and the armature core will run hot, communicating this heat to the windings of the armature and field coils, rendering them incapable of carrying at a reasonable temperature the full current load that the cross section of copper provided would otherwise allow, and in some machines this wasteful magnetic heat has been communicated to the bearings, causing these to overheat and necessitate shutting down.

A machine without magnetic symmetry will overheat at even light loads, thus proving the rule as to temperature, whereas a machine of proper design will remain practically constant in temperature at all loads or until the capacity of the copper windings is fully attained.

To sum up, the claim is made that the successful dynamo or motor (following in design the present recognized theories of magnetic changes) having but a single magnetizing field coil, it matters not whether the machine be for alternating or direct current, is yet to be designed, and that any single coil machine is and will be defective, inefficient, regulate badly, overheat through hystereris, and that a two-coil inductor alternator of proper design overcomes all the objections mentioned.

This theory was enunciated by us as far back as 1885, and has been reasserted in printed matter we have issued at several later periods, and while it is an extremely simple point not in any case claimed as original with the writer, as it has evidently been recognized by designers of multipolar machines, perhaps, however, inadvertadly, as the use of the multipolar type of field originally arose from the desire to obtain low speed and subdivision of current in commutation of direct current machines, yet in the inductor type of alternator the use of more than one field has been entirely overlooked by all manufacturers.

A machine embodying the very desirable feature of close inherent regulation is now manufactured in Toronto by the United Electric Company, Limited, and the correctness of the theory as herein stated is proved by the fact that this machine has practically no magnetic heating in the ordinary sense of the term in the iron or steel of any portion of the frame, inductor or armature core, in fact, under test at overload, it having been under 30 degrees Fahrenheit above surrounding atmosphere after a previous full load run of fourteen hours.

PERSONAL.

The congratulations of many friends are being extended to Mr. W. A. Martin, secretary of the Toronto Electric Light Company, upon the occasion of his recent marriage to Miss Bowling.

The exhibitors in Machinery Hall at the late Toronto Industrial Exhibition presented Mr. T. Eversfield, chief engineer of the hall, with a bedroom set and an address expressive of his kindness and consideration during the fair.

The news has been received in Montreal of the marriage in England of Mr. Ernest G. Coker, B.B., B.Sc., assistant professor of civil engineering in McGill University. Professor and Mrs. Coker were expected to arrive in Montreal about the end of September.

Mr. John J. York, chief engineer of the Board of Trade building, Montreal, has tendered his resignation, to accept a similar position at the St. Lawrence Sugar Refinery. He has been succeeded by his brother, Mr. B. A. York, who for the past four years has been inspector for the Boiler Inspection and Insurance Company of Toronto.

Mr. W. J. Johnston, late editor of the Electrical World, of New York, is at present on a tour around the world. Mr. Johnston sailed from San Francisco, the first stages of his journey being the Hawaiian Islands and Japan. In the Orient, Korea, China, Manila and Java will be visited, and about six weeks passed in India. The entire trip will occupy about eight months, and comprises visits to Egypt and Turkey.

BY THE WAY.

WHEN old timers in various departments of the electrical business get together, they are apt to indulge in reminiscences of an interesting character. The old telegraph man by way of illustrating the resourcefulness of the pioneers, will tell how a stove pipe was once utilized to make contact between the ends of a broken wire when nothing better adapted to the purpose was in sight, and how to everbody's surprise it did its duty nobly and well. Another will describe the first insulated office wire as having a covering of hemp and red sealing wax. At this point the electric light man will probably start in to prove that expensive insulation is not as necessary for the prevention of fires as it is supposed to be. By way of experiment he once put up a number of 52 volt incandescent lamps on bare wires placed in contact with wood, then turned on the hose and no fire resulted. The electric light man believes, and there appears to be ground for his opinion, that the fire underwriters' regulations governing the method of wiring, should take the voltage into account. He also thinks that it should be made permissible if not compulsory, as in England, to ground secondary wires, to prevent trouble from contact. These and many other subjects of equal interest engage the attention of the old timers when by chance they meet.

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"AN odd institution that has lately come under my notice," said a friend of mine the other day, "is the railway, twelve miles in length, between Grenville and Carillon on the Ottawa river. This railway is employed for the transport of passengers and baggage coming by steamer from Montreal to Ottawa and vice versa. The train, which consists of a locomotive and one car, makes only one trip per day, leaving Carillon on the arrival of the boat from Montreal, and on the return, leaving Grenville on arrival of the steamer from Ottawa. The line runs through fields some distance from the river. The roadbed and rails cannot be seen except at close range, being overgrown with grass. At a glance the engine is seen to be an old timer and probably will not stand a pressure of more than 30 to 40 pounds. It looks very like the first locomotive put into service on the old Northern Railway, and which I understand was built at Good's foundry on Queen street, Toronto. An old gentleman, grey haired and grey bearded, attired in a long black coat, white tie and high collar, and presenting the appearance of a superannuated Methodist preacher, occupies the dual position of conductor and brakeman. Notwithstanding his antiquated appearance, however, he seemed to be rather more than up-to-date in his movements, for on the whistle sounding 'down brakes,' he responded so quickly that the locomotive and car were brought to a stop some distance before the platform which does duty as a station, was reached, and the train had consequently to be started up again to reach its destination." In concluding his description, my friend remarked that the old conductor must have a great task on his hands in making up his daily returns for the railway company.

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THE electrical situation at Ottawa is at present an interesting one. Speculation is being indulged as to the outcome of the efforts which are being made to subject to competition the Ottawa Electric Company, which until now has furnished the entire supply of electricity for public and private purposes. The Deschene Electric Co., which failed to secure a franchise, has gained an entrance to the city over government property alongside the canal, in return for lighting the canal. Thus far the company are lighting only one or two of the large buildings, and it seems doubtful whether they will become an important factor in the situation, as they are not allowed the use of the streets. The Metropolitan Electric Company has been organized and has obtained a franchise from the council, to utilize a water power seven miles distant to generate and transmit electricity for light and power to the city. This enterprise involves the construction of a canal at considerable cost. The company are doing some preliminary work in the neighborhood of the water power, but it is said are experiencing difficulty in getting the requisite capital subscribed. The opinion is expressed in Ottawa, that the company would prefer to sell out to the Ottawa Electric Co., if the way should open up for satisfactory negotiations. It is also reported that the Ottawa Electric Company have an option upon an equally good water power situated two or three miles nearer the city. Perhaps the best available water power is one situated on the Ottawa river, about 35 miles above Ottawa. Here a natural dam is formed by several islands with narrow spaces between. This power, which is the property of the Quebec government was recently offered for sale by auction. A condition was that the purchaser must expend the sum of $300,000 upon development work, which had the effect of preventing offers. The fact that Nature has left so little to be done for the development of this power, should have prevented the insertion of such a condition. There are numerous water falls on the Gatineau, but the turbulency of that stream is such that the still water necessary to the avoidance of anchor ice, prevents their utilization for electrical purposes.

SPARKS.

The power house of the Canada Electric Light Co., at Amherst, N. S., was partially destroyed by fire on September 10th. The loss is believed to be covered by insurance. N. A. Rhodes and D. W. Robb are members of the company.

As a result of recent labor troubles in connection with the operation of the street railway at London, Ont., the council is said to be considering the purchase of the street railway property and its operation by the city as the best means of putting an end to the present unfortunate condition of affairs. In the event of being unable to buy out the existing company, a rival road is spoken of.

Application has been made to the Ontario government for the incorporation of the Port Stanley Electric Railway Company, to construct an electric railroad from Port Stanley to St. Thomas and London. The road, it is thought, could be constructed and equipped at an outlay of a quarter of a million dollars. The promoters of the scheme are the London and Port Stanley Gravel Road Company, who talk of having the road completed by May 24th next.

News has come to hand of the death, under distressing circumstances, of Mr. W. A. M. Pollock, electrician at the electric light station at Almonte, Ont. Deceased was engaged in rubbing powdered resin on a revolving pulley to keep the belt from slipping, and was standing in a narrow space at the end of shafting. By some means his right arm was caught in the belt, and he was thrown head foremost between the pulley and the bridge-tree. He was carried half way round the pulley and suspended head down, being wedged in the narrow five inches of space between the pulley and the bridge-tree. When extricated it was found that the arm of the deceased had been wrenched off at the elbow, and that he had received other serious injuries. Medical assistance was at once procured, but Mr. Pollock succumbed to his injuries in less than three hours. Deceased was a respected and well known resident of Almonte, and leaves three small children. He had been employed by the Almonte Electric Light Company for thirteen years.

UNDERGROUND CONDUIT FOR ELECTRIC WIRES.

THE Ciiy Council of Ottawa, through its Fire and Light Committee, a few weeks ago instructed the city engineer, Mr. John Galt, to report upon the feasability of placing the electric light, telegraph and telephone wires underground. Mr. Galt's report, together with a preliminary sketch showing the proposed method of subway construction, will be found below :

To Chairman and Members of Fire and Light Committee :

GENTLEMEN,—Acting upon your instructions to investigate and report upon the feasability of having all electric wiring underground, so as to obviate the nuisance of the overhead system constructed and carried upon unsightly poles along the streets of the city, I beg to report as follows :

Underground wiring is quite practicable from a civil, mechanical and electrical standpoint, notwithstanding the objections, difficulties and obstacles to be encountered.

The most important feature to be considered from the standard of municipal requirements is the system of underground work. The ideal method, unquestionably, would be separate open subways on each side underneath the sidewalks or along the street roadway, close to the gutter or curbing, large enough in size for the accommodation of water, gas, electric wiring, etc., including facilities for examining, making repairs and house connections.

This seems to be the only suitable plan of subway construction, and will give separate underground space on each side of the street for pipes and wire service to the street line. Of course this, you see, would require duplicate water and gas mains, but there could be no objection outside of the extra cost, because in the central portion of the city this is both desirable and highly advantageous, subway or no subway.

My conclusions are as follows :

(1) In cities overhead wiring is highly objectionable from every standpoint.

(2) Underground systems are practicable for all kinds of service, notwithstanding the serious objection urged, including interference on account of electrical induction.

(3) A single subway in the middle of the street, although practicable, is entirely unsuitable, because connections to house property would require constant cutting up and repairing of streets.

(4) It is more than apparent, without further explanation or illustration, that under municipal ownership the extent and interference in the tearing up of streets will be reduced to a minimum.

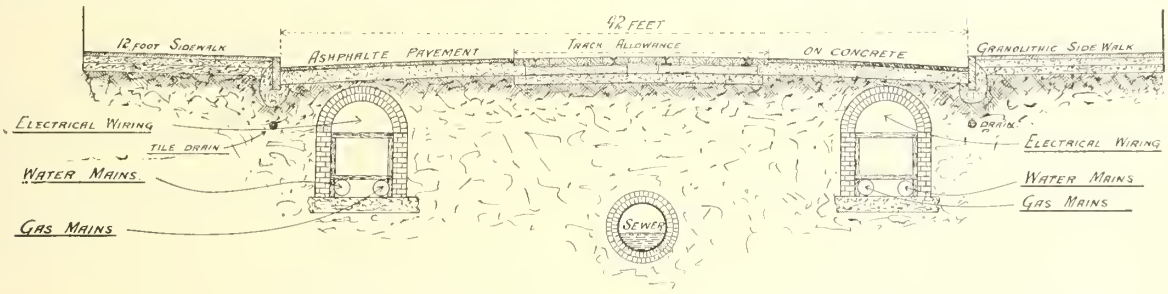
(5) In the end the results will be highly satisfactory and economical to all concerned, while at the same time the dangerous, annoying and objectionable overhead system would be abolished.

In conclusion, I submit a preliminary sketch showing a brick lined underground subway 4 ft. wide by 4¼ ft. high, located inside the roadway, close to the curbing.

The total cost for the actual construction of this double subway on the ordinary macadam roadways would be $12 per lineal foot, and on permanently paved roadways $16 per lineal foot, to which, of course, would have to be added all the other large incidental expenses connected with the conversion of the present system into the new. If the subways were placed directly underneath the concrete walks, the cost of construction would be increased 25 per cent., and would still have to cross over roadways at all street intersections and in addition be a serious hindrance to pedestrian traffic during period of construction.

Your most obedient servant,

JOHN GALT, City Engineer.



PROPOSAL FOR UNDERGROUND CONDUIT—CITY OF OTTAWA.

VISIT TO THE CHAMBLY WORKS.

AT the special invitation of Mr. Rudolph Forget, president of the Royal Electric Company, a party, composed of the directors of the Royal Electric Company and their friends, paid a special visit to the Chambly Rapids power house on Saturday, Sept. 9th. A special train carried the party to Chambly Canton, where the power house is situated. Mr. W. H. Browne, the general manager, and Mr. P. G. Gossler, the engineer, showed the visitors through the power house and explained the machinery used in the generating of power. At present there are four huge generators in operation, having a capacity of 3,000 h.p. each, making a total in operation of 12,000 h.p. The ultimate capacity of the power house is calculated at 25,000 h.p. Mr. Browne explained to the visitors that the generators were the largest machines of the kind that had ever been built, even larger than the Niagara Falls machines, and he was especially proud of the fact that they had been made at the Royal Electric Company's works in Montreal. The many interesting features of the plant were explained to the visitors, and the extraordinary precaution which is taken against lighting storms was shown. The visitors were greatly impressed by the machinery and the perfection of all the arrangements.

Among the visitors was Mr. W. R. Eckart, of San Francisco, the representative of the Blue Lakes & San Francisco Electrical Company, which is putting in a plant to supply power from the Blue Lakes, in the State of Nevada, to San Francisco, California, a distance of 150 miles, at a pressure of 60,000 volts, the highest voltage ever attempted and the longest distance transmission in the world. The machinery for this has been ordered from the Stanley Electrical Manufacturing Company, of Pittsfield, Mass., the associate company of the Royal Electric Company, Montreal, and a special object of Mr. Eckart's visit to Chambly was to inspect the machinery. He expressed himself as much impressed with the perfection and completeness of the machinery and arrangements.

The longest distance transmission in Canada is that of the Cataract Power Company, of Hamilton, being 37 miles from the generator to the motor, and the above mentioned plant from the Blue Lakes to San Francisco is the longest and highest voltage in commercial operation in the world. These facts are a strong testimonial to the efficiency of Stanley apparatus for the transmission of power over long distances.

SPARKS.

Early in October the British Columbia Electric Railway Company will commence the construction of a tramway line from Victoria to the Gorge, about two miles distant.

The Ottawa Electric Street Railway Co. have just let the contract to Messrs. Henney & Smith for the construction of a branch line to Britannia, a distance of about five miles. The contract price is $40,000, the company furnishing the rails, poles and ties. The road will be double tracked for the entire length.

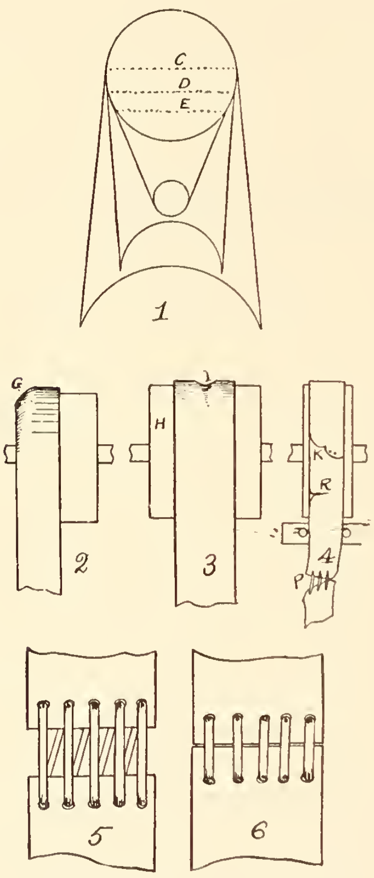
Mr. N. Pinze, of Montreal, has invented a new street car fender, which is to be tested by the Montreal Street Railway Company. The new fender is made of slats of iron or wood fitted on to a frame, which is attached to the front of the car. The slats are concave in shape, but the edge above the track is oblique instead of straight. By an ingenious contrivance the motorman can, when he sees any one on the track in front of him, drop the fender edge upon the track so that its oblique edge will only be a fraction of an inch from the ground. The outside end of the fender is supplied with small wheels or rollers which rest upon the rails and prevent the fender from forming an obstruction to the forward motion of the car by coming in contact with the ground. In addition, the new fender is supplied with springs which relieve the shock of the blow inflicted by a body coming in contact with the fender when the car is in motion.

ENGINEERING and MECHANICS

LUBRICATION OF LEATHER BELTS.

THE consumption of oils and greases for the lubrication of leather belts is much larger than many suppose. There are, of course, a number of special belting compounds which are used for the dressing of leather belts[1]; but most of the manufacturing plants and power consumers adhere to the old way of caring for the belts, which consists in cleaning them at intervals with grease and oil, tallow or the like, then allowing the belts to stand until the lubricants have been absorbed. Belts which are run in dye houses, bleacheries, steam laundries and places were the air is moist do not get dry enough to require lubrication. But belting in wood working, metal working, shoe manufacturing, flour and similar establishments is more or less subjected to the dry, dust-laden atmosphere of the rooms, and in time becomes harsh, dry and stiff.

A little oil, grease or similar substance may be used to advantage in restoring the pliability of the leather. The trouble is that some men use too much of the lubricant. If the oil or grease is flowed all over belt and is not given time to impregnate the fibre, the belt will lose its grip on the pulley, and quickly run off. If,



LUBRICATION OF LEATHER BELTS.

however, the softening stuffs are uniformly and lightly applied and given time to saturate the leather, the fiber will gradually assume a softer and more pliable condition, which will improve the driving qualities of the belt and avoid slipping.

But it is not always lack of a lubricant that causes a belt to slip and run to one side. If a belt is so arranged as to take in but a portion of the pulley, like C, Fig. 1, then much of the arc of contact is lost and the belt will slip with a load, even if the leather is properly lubricated. If the arc of contact is increased to that of D, a fuller grip is obtained of the contacting surfaces, and the belt will not be so likely to slip if it is properly limbered up with the right lubricants. If the arc of contact is brought to F, the bite is still more increased, and the danger of slipping averted, other conditions being right.

The most effectively lubricated leather belts will run to one side if the wheels are incorrectly set. This is illustrated in Fig. 2, in which a sample is given for the condition in which the writer finds very many pulleys. For some reason the local machinists are quick to decide that the belt itself, the lubricants, or anything but the pulley itself, is wrong. The tendency for a belt is to run to the high side of a pulley, except in case where the belt pulls down on the pulley, as in Fig. 2, when the belt rides the lowest edge at G. There is but one remedy, and that is to line up the shafting on which the pulley runs. Then the belt will take the centre of the wheel.

In Fig. 3 is a common case. A tight and loose pulley run together, and the belt shifter is adjusted so that but a fraction of the belt runs on the tight pulley. The result is that the belt constantly slips. Lubrication will not help it. Procure a monkey wrench and set over the belt shifter so that the full width of the belt will run on the tight pulley, and the difficulty will be overcome. Or if the tight and lose pulleys are set so as to permit a space to exist between, the belt will sink down as at I, and, of course, produce slippage.

If the tendency is for the belt to take a side of the wheel, Fig. 4, out of line with the guide pins J of the shifter, much trouble will result. The strain coming on that side of the belt, the edge will be broken as at R and K, and probably the joint opened as at P. The remedy again is to level up the shaft and pulley.

Again, it may happen that a correctly adjusted belt and freely lubricated one slips at certain points. Then examine the splices. If the jointing of the belt is open, like that in Fig. 5, it may be seen that the slipping occurs here when the lace leather is riding the wheels. The only remedy is to draw up the lacings and close the butts of the belt, as in Fig. 6.—American Miller.

QUESTIONS ON STEAM ENGINE OPERATION.

A writer in Modern Machinery asks the following questions: 1. How shall I proceed in order to equalize the load on the two pistons of my compound engine, 16 and 30 inches in diameter respectively? At present the high pressure piston does much more work than the low pressure and I wish to remedy the evil. 2. What is meant by re-evaporation in the cylinder of a steam engine? 3. Is it a source of gain or loss in economy? 4. How can it be prevented?

The answers given are as follows: 1. If you have an adjustable cut-off on your low pressure valve gear, shorten up the point of cut-off. This will increase the back pressure on the high-pressure piston, and raise the initial pressure on the low pressure, thus giving more expansion and a better distribution of the steam. If you have no cut-off on the low pressure valve-gear, or if it is not adjustable and you cannot have it made so, lower your boiler pressure and carefully note the effect. This will raise the terminal pressure in the high pressure cylinder, and send more steam to the low pressure? 2. There is always more or less water in the cylinder when running, either from a boiler that furnishes wet steam, from a steam pipe that is not well protected, or on account of initial condensation. After the cut-off has taken place the pressure falls rapidly, and if it is very low near the end of the stroke it so reduces the boiling point that the heat in the walls of the cylinder causes it to evaporate into steam again, but too late to be of any service? 3. It is a source of loss, because it takes heat from the cylinder without producing steam in time to be of value. The result is that when another charge is admitted, some of it is condensed, and this loss frequently is heavy, although often unsuspected by engineers. 4. Measures should be taken to furnish the cylinder with dry steam, it should be well lagged to prevent condensation, and as the pressure cannot fall too low unless the load is light and the cut-off short accordingly, the boiler pressure should be reduced until the terminal pressure is raised. If this is not practical on account of the necessity of maintaining a high pressure for other purposes, a reducing valve may be placed in the steam pipe. These changes will also increase the economy by reducing the loss from other sources.

The District Assembly No. 18, Knights of Labor, Montreal, at a recent meeting, discussed the advisability of petitioning the government to appoint experts to examine electrical plants, it being claimed that accidents resulting in loss of life and limb had taken place through the neglect of the government in not appointing an inspector for this purpose.

ENGINEERING NOTES.

The temperature of water in a boiler is the same as the temperature of the steam. Water cannot be heated higher than 212 degrees in the open air because it evaporates at that point ; but in a closed vessel such as a boiler where there is pressure this tends to retard the boiling and the temperature of the water is always the same as that of steam.

WATER HAMMER.—If steam be admitted at the top of a vessel partially filled with cold water, condensation will take place until the surface is somewhat heated, and this, in connection with a cloud which forms above the surface, will retard rapid condensation, so that in due time the full steam pressure can be maintained above water cold at the bottom. This phenomenon is not an infrequent occurrence in boilers in which the circulation is defective. It is therefore perfectly safe to heat up any vessels containing cold water, if the steam can be admitted from the top upon the surface of the water and so maintained.

OIL TESTING.—A home-made oil tester for a shop consists of a shaft and balls with a shell between. The whole rests in half bearings, around which is put an iron strap, the tension being regulated by a set-bolt. The balls run in grooves. To test, apply the oil, run the shaft and if the bearing gives signs, upon cooling, that the lubricating oil is gumming, it is an indication that resins of similar body-giving substance have been used. Resin oil, if properly distilled, does not produce this clogging. These bearings form pretty good oil testers, and they are sometimes found where they will generate heat with one oil and not with another. Such a bearing will determine the special merits of a machine oil.

BELTING.—The ultimate strength of ordniary bark-tanned single leather belting varies from 3000 to 5000 pounds per square inch of cross section. The thickness of single belting varies from 3/16 inch to 5/16 inch, and from 3/8 to 5/8 inch for double helting, and by taking the mean thickness we get the breaking stresses from 750 to 1250 pounds per inch of width for single belts and 1500 to 2500 pounds for double belts. The safe working tension should never exceed one-fifth of the strength of the joint, which is about one-third the above values. From this we find that by taking 1/5 of 1/3 of the breaking stress, or 1/15, the working tensions are, for single belting, 50 to 80 pounds, and for double belting, 100 to 160 pounds. Belts will run with the minimum of attention for many years, if the tensions do not exceed 50 pounds for single and 80 pounds for double belts per inch of width.—From "Smokeless Heat," by General Engineering Company.

"Orillia," writing to Power, asks : What size wire should be used for field magnet coils and armature of a four-pole dynamo of a capacity of two or three 16-candle power lamps at 107 volts, and what size should the armature be ? The answer given is as follows : A dynamo of two or three incandescent lamps capacity is not a practical machine. Machines of that size cost almost as much to build as a machine which will maintain eight or ten lamps. The smallest sized machine to be used as a dynamo that we would recommend would be one which would as a motor have a capacity of one-half horse power. Run as a dynamo such a machine would have an output of about seven lamps. The wire to be used on the armature would be No. 21 B. & S. gauge. The size of wire on the field would depend entirely upon the design of the machine, shape of the frame, dimensions and so on. A machine of ordinary design would probably require No. 24 or 25 wire in the field coils, but this is of course a mere hazard. The armature of such a machine should be about 3½ inches in diameter and 3½ inches long.

HIGH EFFICIENCY INCANDESCENT LAMP.

SOME time ago the startling news was published that Maxim, one of the pioneers in the invention of the incandescent lamp, had succeeded in improving the lamp so that there would be a saving of 25 per cent. in the number of watts required per candle. It now appears from London "Lightning" that not only has this efficiency been reached, but even exceeded, and that a factory for making these lamps at a rate of 6,000 a day—the largest factory of the kind in England—is in course of construction. The consumption of energy of these lamps is said to be only 2.8 to 3.0 watts per candle, as compared with 4 to 4.5 watts in the usual lamps. No further information is given at present, but more is promised soon.

It is rumored that negotiations are under way looking to the extension of the electric street railway at Moncton, N.B.

EXHIBITS AT TORONTO INDUSTRIAL FAIR.

NOTWITHSTANDING that manufacturers are far behind with orders, the exhibit this year in the Machinery Hall of the Toronto Industrial Exhibition was quite up to the average. A number of manufacturers of electrical and steam apparatus were represented, reference to whose exhibits will be found below. The Canadian General Electric Company welcomed many a visitor for the last time to their show-rooms on Front street, the company having since removed to new offices, fitted specially for their purposes, at No. 14 and 16 King street east.

Entering the Machinery Hall from the east, we found the Royal Electric Company occupying a large space. Their exhibit was made very attractive by several hundred incandescent lights arranged in festoons near the ceiling over the company's exhibit. In a space about 50 x 40 feet there were displayed several S.K.C. dynamos, a complete line of direct current motors and S.K.C. alternating current motors, car motors and controllers, transformers, arc and incandescent lamps, lightning arrestors, switches and volt meters, and, in fact, everything necessary for a most complete central station, whether for railway, lighting or power purposes. The exhibit was much admired by visitors generally, and was of great interest to persons connected with the electrical industry.

A 30 h.p. engine of the regular side crank type was exhibited by the Robb Engineering Company, of Amherst, N. S. It was direct connected to one of the United Electric Co's dynamos. The diameter of the engine cylinder was given as 8", stroke 10", and speed 325 revolutions per minute.

The exhibit of the United Electric Company, of Toronto, consisted of one 45 k.w. inductor alternator, built for Bedford, Que., and one direct current, direct driven multipolar dynamo, driven by a Robb engine, built for the McLachlan Carriage Co., of Oshawa. There were also several steel multipolar motors of the enclosed type, designed for direct connection to all classes of machines and mechanical tools. Besides the above, there were shown arc lamps for direct and alternating circuits, arc dynamos, bipolar motors, transformers, etc.

In the Machinery Hall the Goldie & McCulloch Co., Limited, of Galt, Ont., were among the largest exhibitors. Their machinery included one large "Wheelock" engine, which, by the way, was sold to the Toronto Fair Association, and one 10 x 10 and one 12 x 12 Ideal high speed engine. These latter are of handsome design and finish, very compact and take up very little room, and are suited for either direct connection or belted drive dynamo. Their four gas and gasoline engines attracted much attention, one of these being directly connected to a triple pump. These engines are meeting with a large sale. There was also exhibited a number of wood-working pulleys and wood split pulleys and a gyrator, this latter being a flour milling machine of which this firm is the sole Canadian maker. Altogether, this exhibit was greatly admired by machinery men visiting the exhibition.

A display of gas and gasoline engines was made by the Northey Manufacturing Company, of Toronto. The little "Northey Junior" gasoline engine attracted much attention, it being adapted for the lighter work about a farm, etc. A 5 h.p. horizontal gasoline engine was used to run a Fleury 10 inch plate grinder, and during the Fair repeatedly ground 40 bushels of oats per hour, which is regarded as a good performance. This engine was not using its full power at any time when running the grinder, as it was also used for operating a feed cutter with pneumatic elevator, and did the work put upon it with great ease and regularity. Then there were 3 h.p. and 12 h.p. engines. The latter was operating one of the Northey Co.'s large triplex pumping engines, thus affording a good example of what a modern waterworks plant might be. The engine and pump together were shown to be extremely compact, and the absence of firing, handling of coal, smoke, dirt and ashes were very noticeable. These engines are also used for running dynamos direct for the lighting of gentlemen's residences and for other isolated plants. The manufacturers claim that they are the only engines built in Canada which will do direct work on a dynamo successfully, others having to use a storage battery between engine and lights.

The exhibit of the Electrical Construction Company, of London, was very instructive to those interested in the important details of construction of electrical apparatus, they having the parts of machines on exhibition showing the detail of construction and high class workmanship of their apparatus. Their slow speed motor, 12 h.p., running at 250 r.p.m., showed to advantage the adaptability of their motors for direct connection to printing presses and other slow speed machinery under direct electric control of the operator. Their 300-light dynamo, at 500 r.p.m., introduced a class of machines which, owing to their slow speed, cool and sparkless operation, bring forward to particular prominence the life of the dynamo, which is claimed to be almost without limit under these conditions.

TELEGRAPH and TELEPHONE

WIRELESS TELEGRAPHY FOR MARINE PURPOSES.

Mr. F. A. Hamilton, M.I.E.E., M.Can.Soc.C.E., contributes to the Halifax Echo a long letter on the value of wireless telegraphy for naval, military and shipping purposes, and more particularly in connection with the marine interests of the world. Concerning its employment in the latter sphere he says:

"Without soaring in imaginative flight to the realms of speculation and rambling conjecture, let us at once proceed to consider, in a matter-of-fact way, the actual work which this young and promising ariel has accomplished, and what he is ready and eager to perform at the present moment. By means of this messenger a moving object can be kept in telegraphic communication with any other moving object or a fixed station. A ship fitted with the apparatus cannot only keep in telegraphic communication with the shore up to any reasonable distance—it has been long since thoroughly tested up to over 30 miles off the shore—but ships can also, if thoroughly equipped, be warned of approaching danger or their proximity to dangerous coasts where the signalling appliances are placed. Fog, rain, snow and wind in no way impair the efficiency of this system of telegraphy, and herein lies its especial value for marine signalling."

Mr. Hamilton then takes as an example the case of an ocean steamer bound from a home port to one on our own shores, and shows how, having put to sea under conditions of drizzly weather and freshening wind, she can, by means of the telegraph system, communicate with passing ships and, if need be, give to an incoming vessel the bearing of and distance of the lighthouse or headland she has left behind her.

As showing the field for the employment of wireless telegraphy off the Atlantic seaboard of Nova Scotia, Mr. Hamilton says: "Between Seal Island and Cape Race there are several important lighthouses—including those on Sable Island—which might, with very great advantage to shipping, be provided with the means of signalling to a distance of thirty miles, or a less distance if desirable; and likewise on the Labrador coast, in the Straits of Belle Isle and in the Gulf of St. Lawrence, where navigation is at times both difficult and dangerous. The establishment of such facilities would be a boon to commerce and a credit to the country, to say nothing of the possibility of its being made a source of revenue, or at any rate self-supporting. There are, of course, details to be considered in connection with such a scheme, such as making some stations signal stations only—that is to say, they would simply and automatically signal their number or designation—whilst other stations would be equipped for telegraphic communication. Then, again, it might be necessary in some instances to project the signals over a prescribed number of degrees, as, for instance, near the approaches to a harbor, in which case two stations might emit signals over a certain arc, so as to render it possible for a vessel to get a cross-bearing and establish her position."

Then Mr. Hamilton concludes: "The system has been in practical use in the Italian navy for over two years, and for several months has been the means of communication between the South Goodwin lightship and the South Foreland lighthouse, in the Straits of Dover. Telegraphic messages have been exchanged between stations on the coasts of England and France, and communication with passing vessels established. An interesting feature in the experiments is the facility with which Mr. Marconi succeeds in cutting out a third station so that it cannot interfere with the other two. The advances made in the application of wireless telegraphy to practical work have been such as to justify the belief that it will become a sine qua non to every coast and to all classes of vessels, whether on the ocean or in the great lakes."

Mr. H. W. Kent, general superintendent of the New Westminster & Burrard Inlet Telephone Co., is at present on a visit to his home in Peterboro', Ont. It is Mr. Kent's intention to visit Chicago, Cleveland, Toronto, Montreal and other cities for the purpose of inspecting the latest telephone switch-boards and appliances in existence, with a view to adopting the most improved system in the Vancouver Exchange. At present there are on the Vancouver Exchange over 800 subscribers, and the business has grown to such an extent that a switch-board of increased capacity has become a necessity.

SHORT CIRCUITS.

Mr. B. H. Turner will probably introduce a local telephone system at Manitowaning, Ont.

The Hudson Bay Co. are about to establish telephone connection from Fort Smith to Smith Landing, a distance of 160 miles on the Great Slave river.

The Department of Public Works at Ottawa invites tenders up to October 5th for the supply of 165 tons of galvanized iron telegraph wire for the Lake Bennett-Dawson line.

Mr. E. A. Dempster, chief clerk in the Great North-Western Telegraph Company's office at Hamilton, has been moved to Fort William, to accept a responsible position with the Canadian Pacific Railway Company.

The Columbia Telephone & Telegraph Co. is about to construct 50 miles of private telephone lines, extending from Grand Forks, B. C., to the various mines in the vicinity. An order has been given by Mr. J. P. Graves.

Ora P. King, Fred Bonnell, D. H. McNuit and R. B. Harmer are seeking incorporation as the Sussex and Hammond Telephone Co. They purpose erecting a telephone line this fall from Sussex to Jeffries' Corner, N. B., and will extend it to other points later on.

The Bell Telephone Company are making a number of extensions and improvements to their lines along the south shore of the St. Lawrence. Underground conduits have been laid as far as the Victoria Bridge, Montreal, and it is expected to have the line to St. Lambert completed in a short time.

The Dominion government has just let the contract to X. Gendreau, of Quebec, for the extension of the telegraph system from Big Roumaine, Que., to Chateau Bay, Labrador, opposite Belle Isle. The length of line to be constructed is 315 miles. The poles will be supplied by C. J. Bickerdike, of Montreal.

The annual general meeting of the shareholders of the Great Northwestern Telegraph Company was held at the head office in Toronto on September 27th. The old Board of Directors and officers were re-elected, viz: President, H. P. Dwight, Toronto; vice-president, Adam Brown, Hamilton; directors, H. N. Baird, James Hedley, A. S. Irving, W. C. Matthews, Toronto; Richard Fuller, Hamilton; Hon. Wm. McDougall, Ottawa, and Chas. A. Tinker, New York; secretary and auditor, Geo. D. Perry; treasurer, Arthur Cox. The financial statements presented showed a marked improvement in the revenue of the company over the previous year, and it was stated that the outlook for the coming year was still more hopeful.

Mr. M. T. Quigley, manager of the C.P.R. telegraph office a Vancover, B. C., is authority for the statement that his company has made arrangements with the Dominion government for connection with the line now being built in the Yukon district. The system to be be adopted will be that of sending merchants' filing messages in the Vancouver offices of the companies doing business there, the latter to transmit them by special arrangements on all steamers going north. The idea is to have packages of messages go, say, every other day from Vancouver. At Skagway they will be placed upon the line to Bennett, and at the latter place will be transmitted to the line being built by the Dominion government and forwarded to Dawson.

Mr. Chas. Park has been engaged as teacher in Electricity and Steam Engineering at the Toronto Technical School. Mr. Park was one of the four students who took the electrical course at the School of Practical Science, Toronto, in the first year after its establishment. Under his direction it is expected that the electrical and steam engineering courses at the Technical School will become even more efficient than in the past.

Messrs. McManus, Lowe & McManus, Sydney, C. B., are installing for the Nova Scotia Steel & Iron Company, a complete electric lighting plant, consisting of one 75 k. w. S.K.C. two phase generator and a complete equipment of 60 alternating current enclosed arc lamps. This, we believe, is the first installation in Canada where an alternating current generator has its capacity entirely taken up with arc lamps alone, and speaks well for the future of alternating current arc lamps and also of the progress being made along these lines. The entire plant was furnished by the Royal Electric Co., of Montreal.

TRADE NOTES.

The Robb Engineering Co., Amherst, N. S., are supplying the town of Neepawa, Man., with a steam plant for their new electric lighting system—a 100 h.p. compound engine and two 75 h.p. Mumford improved boilers.

The corporation of the city of Winnipeg, through its Water and Light Commissioners, have awarded the contract for their incandescent electric lighting plant to the Royal Electric Co., of Montreal, the plant to consist of a 60 k.w. S.K.C. two phase alternating generator, with the necessary transformers, etc. The order for the arc apparatus was placed with the Western Electric Co., of Chicago.

Over five thousand letter carriers visited Scranton, Pa.., on Labor Day, and took part in a parade which preceded the business session of the tenth annual convention of the National Association of Letter Carriers. In honor of the occasion, the business houses of the city were handsomely decorated and electrical devices were freely used. The International Correspondence Schools had a large monogram, I. C. S., with letters composed of red, white and blue incandescent lamps, in front of their building, making a very fine display. This institution has over one hundred thousand students, and as its mail is handled by carriers in all parts of the country, they were much interested in inspecting the home office at Scranton. A constant stream of visitors went through the building and on Friday evening an informal reception was given the letter carriers. Hundreds of them visited the building and saw how the work of the largest school in the world is conducted. The instructors, text book writers, correspondents, bookkeepers and other employees were at their desks, and the printing department was also in operation. Over 500 people are employed in the building, which is one of the finest in the city, having been erected especially for the International Correspondence Schools at a cost of $250,000.

The United Electric Company, Limited, of Toronto, have been rushed with orders recently, necessitating the operation of their factory 13 hours per day for the last two months. The following are some of the recent sales of their apparatus: R. E. T. Pringle, Montreal, two 6 h.p., two 8 h.p., and one 2 h.p. motors; J. & G. H. Young, Montreal, one 6 h.p. motor; Dominion Bridge Co., Montreal, two 10 h.p. motors; Kootenay Electrical & Construction Co., Nelson, B. C., 10 k.w. generator direct connected; McEachern Heating & Ventilating Co., Galt, one 5 h.p. motor; McGregor & McIntyre, Toronto, one 8 h.p. motor; John Turner & Sons, Toronto, one 10 h.p. motor; B. V. Naylor, Nayor, Que., 5 k.w. dynamo; Bourque & Poulin, Ottawa, one 12 h.p. motor; Auburn Power Co., Peterboro, one 4 h.p. motor; Darling Bros., Montreal, one 6 h.p. and one 8 h.p. motors; Toronto Lithographing Co., Toronto, one 8 h.p. motor; Royal Mfg. Co., Toronto, one 10 h.p. motor; Crompton Corset Co., Toronto, one 6 h.p. motor; E. S. Stephenson, St. John, N. B., one 2 h.p., one 5 h.p., and one 4 h.p. motors; Rat Portage Lumber Co., Rat Portage, one 15 k.w. dynamo; Alex. Dobson, Beaverton, Ont., one 4 h.p. motor; J. W. Skinner, Mitchell, Ont., a 60 light dynamo; Goderich Organ Co., Goderich, a 100 light dynamo; Dominion Bridge Co., Montreal, 25 arc lamps; C. T. Young, Beaverton, one 2 h.p. motor; Miller Bros. & Toms, Montreal, two 8 h.p. motors; Northey Mfg. Co., Toronto, one 4 h.p. motor.

SPARKS.

Mr. Edward Campbell, electrician, of Toronto, died in St. Michael's hospital recently.

The ratepayers of Weston, Ont, have voted in favor of installing an electric plant, at a cost to the municipality of $7,000.

The Nova Scotia Electric Light Co., which purposes supplying light and power on a somewhat extensive scale, have engaged an engineer to report on various water powers. Their options include the head waters of the Gaspereau river and the Currell brook at Bridgetown. Mr. J. W. Beckwith, of Bridgetown, N. S., is interested.

Mr. F. A. Cheney, of St. Catharines, states that arrangements are completed for the extension of the road to Port Dalhousie, and an effort will be made to convert the existing twelve miles of road into an electric line this fall. It is expected that the passenger service will be run by electricity this fall, but the freight business will be operated by means of steam until next spring.

Again the council of the city of Ottawa are discussing municipal ownership of the electric plant for civic lighting. Two companies have now to be dealt with, the Ottawa Electric Company and the Metropolitan Company, the works of the latter being only under construction. The Ottawa Company has named the following figures as the value af their assets: Capital stock, fully paid up, $765,800; debentures, bearing interest at 5 per cent., $320,000; accounts owing, bills payable, etc., $155,940,41; total, $1,241,740.41. The general opinion is that municipal control of electric lighting in Ottawa is yet far distant.

MOONLIGHT SCHEDULE FOR OCTOBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 6.10	A.M. 3.50	9.40
2....	" 6.10	" 4.50	10.40
3....	" 6.10	" 5.00	10.50
4....	" 6.10	" 5.00	10.50
5....	" 6.10	" 5.00	10.50
6....	" 6.10	" 5.00	10.50
7....	" 6.10	" 5.00	10.50
8....	" 6.30	" 5.00	10.30
9....	" 7.30	" 5.00	9.30
10....	" 8.30	" 5.00	8.30
11....	" 9.40	" 5.10	7.30
12....	" 10.40	" 5.10	6.30
13....	" 11.00	" 5.10	6.10
14....	"........	" 5.10	5.10
15....	A.M. 12.00	....	
16....	" 1.10	" 5.10	4.00
17 ...	" 2.20	" 5.10	2.50
18....	No Light.	No Light.	.....
19....	No Light.	No Light.	.....
20....	No Light.	No Light.	.....
21....	P.M. 5.40	P.M. 8.00	2.20
22....	" 5.40	" 8.50	3.10
23....	" 5.40	" 9.50	4.10
24....	" 5.40	" 10.50	5.10
25....	" 5.40	" 11.50	6.10
26....	" 5.30	A.M. 12.50	7.20
27....	" 5.30	" 1.00	7.30
28....	" 5.30	" 1.50	8.20
29....	" 5.30	" 2.40	9.10
30....	" 5.30	" 3.40	10.10
31....	" 5.30	" 4.40	11.10
		Total.........	209.50

SPARKS.

The electric light commissioners of Thorold, Ont., have been empowered to purchase a transformer.

The Coaticook Electric Light & Power Company, of Coaticook, Que., is now at work on a new power house on the old beet factory site.

Little Dorothy (greatly surprised at seeing a hoseless carriage go by), "My, there's a carriage that's walking in its sleep!"—Youth's Companion.

Mr. John E. Wilson, city electrican of St. John, N.B., has recommended improvements to the fire alarm system, at an estimated cost of $7,000.

A stationary engineers' association has been organized at Regina, N. W. T. Geo. Cook is president, T. S. Hiscox secretary, and P. Gilchrist treasurer.

The present contract for electric lighting in Midland, Ont., expires at the end of this year, and the question of renewal will be taken up at an early council meeting.

The Kay Electric Company, Hamilton, is about to be wound up. At a recent meeting of creditors the assets were shown to be $2,312.24 and the liabilities $1,721.03.

"I wish to see some of the current magazines, please." "Current magazines? Certainly. John, show this lady the Electric Spark and the Storage Battery."—Ex.

The Stratford Electric Light Company are erecting a smoke stack 100 feet high and 14 feet at the base. It is not improbable that another boiler will be installed in the near future.

The Ottawa Power Company has been formed, with a capitalization of $250,000. The members thereof are W. C. Perkins, A. W. Fraser, M. C. Edey, J. R. Armstrong and John Fraser.

Wm. Brown McLean, B. A. Sc., of McGill University, Montreal, has been awarded a science research scholarship of £150 a year, tenable for two years, by the London Exhibition of 1851.

The J. H. Ashdown Mfg. Company, of Winnipeg, have purchased from the Electrical Construction Company, of London, Ont., one of their 500 volt, slow speed, multipolar 10 h.p. motors.

Thomas Hocking, F. W. Drake, John Henry McIntyre, Wm. McLandress and J. B. Crawford, of Dutton, Ont., have been incorporated as the Dutton Electric Light Company, with a capital of $15,000.

The Cataract Power Company have made a proposition to the council of Hamilton to operate the sewage interception works by electricity. Another offer has also been made to pump the city's water supply.

Mr. Geo. C. Robb, inspector for the Boiler Inspection and Insurance Company, of Toronto, has inspected the boilers in the various fire stations in the city of Ottawa, and has recommended that some of them be replaced by new boilers.

The Sturgeon Falls Pulp Co., of Sturgeon Falls, Ont., has asked the town for another bonus of $12,000, in return for which they agree, among other things, to renew the electric lighting contract for a term of 21 years, and to install a telephone system.

The Electrical Construction Company, of London, Ont., have recently closed with the E. Girardot Wine Company, of Sandwich, Ont., for a new 6 h.p. motor. This company have had one of the same motors for the last five years, and express themselves eminently satified with it.

The Brantford Electric & Operating Company, Brantford, Ont., are rapidly increasing their power business. The Keys, Somerville Printing Co. have installed a 3 h.p., two phase S.K.C. induction motor with which to operate their new printing presses. This is the second printing establishment that has put in alternating motors.

The Electrical Construction Company, of London, Ont., in their recent deal with the Winnipeg Street Railway Company for the exchanging of 500 volt motors for the 250 volt system previously in operation there, will have in the course of a few days 80 second hand motors of all sizes, which they will be able to place on the market at very reasonable figures.

The Electric Maintenance and Construction Co., of Toronto, Limited, advise us that they are extremely busy with contracts outside of house wiring and the Orillia contract. They have several large jobs on hand, including the contract for the entire installation of the electric lighting plant for the Gerhard Heintzman Piano Co., Toronto, this being a plant of 250 lights, with 20 k.w. generator, switchboard, etc., complete. It is proposed to use a Canadian General Electric dynamo.

The St. Catharines Cold Storage & Forwarding Co., Limited, are replacing their direct current power service in use in their warehouse with a 15 h.p., two phase S.K.C. induction motor. The current for this machine is supplied by the St. Catharines Electric Light & Power Co., who have recently installed in their power house a 200 kilowatt two phase S.K.C. generator for both lighting and power purposes.

Messrs. Brewder & McNaughton, contractors for the power canal of the Metropolitan Electric Company of Ottawa, have thrown up the contract, for the reason, it is said, that they tendered too low. It is the intention of the directors of the Metropolitan Company to complete the work themselves, a large number of men being now at work, under the direction of the chief engineer, Mr. Aylen.

The Electrician, of London, Eng., publishes a short description of the Desaymar lamp. The principle of it is that the filament is wound in the form of a coil around a specially prepared cylinder of a body which is brought to incandescence, apparently from the heat of the filament. The lamp is said to be brighter, and it is claimed that only half the energy is required to produce the same candle power, the saving therefore being about 50 per cent.

The Demarara Electric Company has been organized in Montreal, for the purpose of doing business in Demarara, West Indies. The franchises of the British Guina Light & Power Company and the Georgetown Tramway Company have been secured, and it is proposed to convert the latter system into an electric road. Engineers have completed the surveys. Messrs. W. B. Chapman, James Hutchison and B. V. Pearson are the provisional directors of the company.

At a recent meeting of the Vancouver city council, a letter was read from the secretary of the Board of Fire Underwriters, stating that that body had appointed Mr. A. K. Snelling to the position of electric wiring inspector, vice Mr. McMicking, resigned. The letter embodied a request that the council pass a by-law enforcing the inspection of electric wiring, the Board of Fire Underwriters to pay the inspector by fees, and the wiring to be done satisfactorily to that official. This was agreed to by the council.

At the last meeting of the council of Greenwood, B. C., the question of the extension of the electric light franchise was considered. Messrs. W. A. Campbell and J. McGregor have an option on the Boundary Falls for power purposes and the electric light franchise for the city. The latter expires on October 15th, and unless a steam plant is put in to generate power, it was stated that it would be impossible to complete the deal. The promoters agreed to put in a steam plant at once, although in a couple of months they expect to have their water power in operation.

A fatal accident occurred at Sherbrooke, Que., when a lineman named Benoit, employed by the Sherbrooke Gas & Water Company, was killed by coming in contact with a live wire. Another man named King was also rendered unconscious, but he will recover. The men in question were about to put up a lamp. They proceeded to lower the brace to which the lamp was attached, and not having a crank handy to work the small windlass on the pole, Benoit and King took hold of the windlass wire rope so as to undo the "dog." The former had both his hands on the wire, while King only used his right hand. Immediately King cried out, but so strong was the current that Benoit never spoke, and before assistance arrived he was dead, having received a current of 2,000 volts. His hands were burned to the bone, and the side of his face was badly scorched through coming in contact with the wire, in his struggle to free himself.

The Parry Sound Electric Light Co. held its annual meeting last month. The election of directors resulted as follows: S. Armstrong, J. F. Mosely, W. B. W. Armstrong, E. J. Vincent, Dr. Walton, Rev. W. Evans and John Clark. Mr. E. Pirie moved, seconded by J. F. Mosely, and carried unanimously, that we, the shareholders in the Parry Sound Electric Co., Limited, at the annual meeting assembled, desire to place on record the esteem in which we have always held our retiring manager and secretary-treasurer, Mr. W. B. W. Armstrong, and to express our confidence in his integrity and ability which he has so steadily displayed in the conduct and management of the company's affairs; and while we regret exceedingly that Mr. Armstrong has decided to sever his connection with this company, we heartily wish him every success in the profession he has decided to enter. The directors have elected Dr. Thos. S. Walton president; E. J. Vincent vice-president; J. H. Knifton auditor; and J. W. Easton secretary-treasurer and manager.

THE ELECTRIC PLANT OF THE MONTREAL COTTON COMPANY.

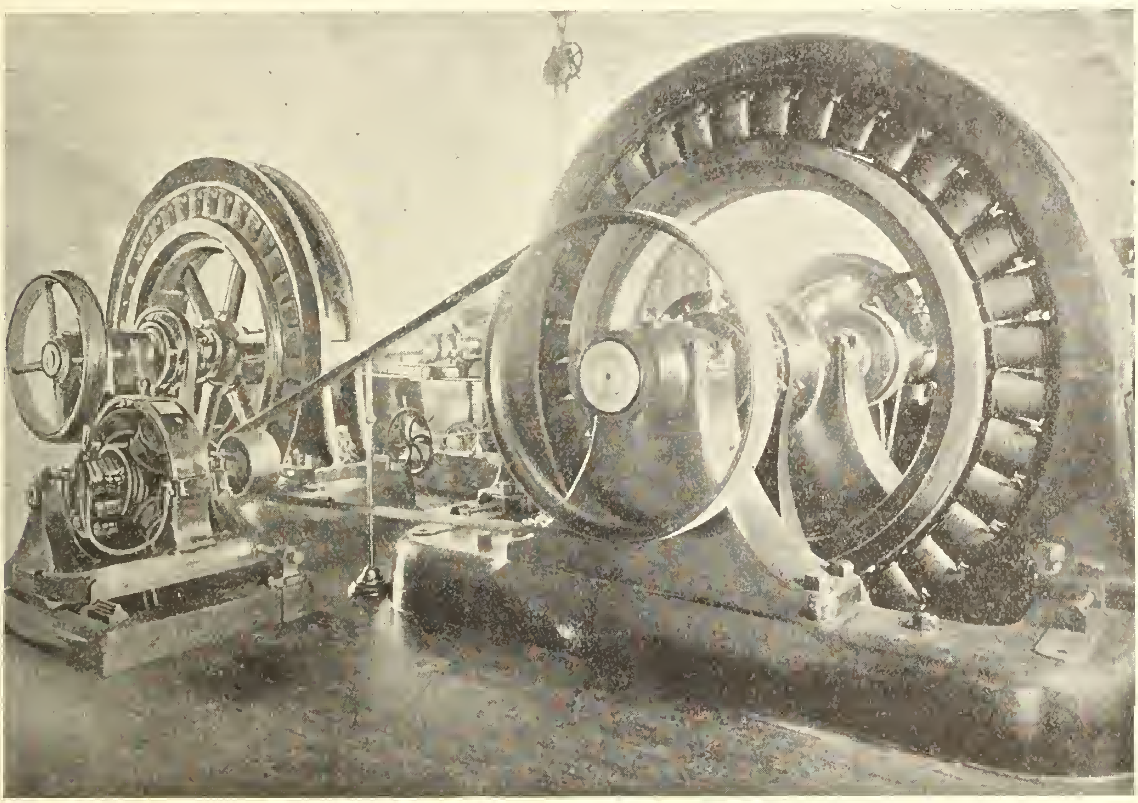
Visit of Inspection by the New England Cotton Manufacturers' Association.

On October 5th and 6th the New England Cotton Manufacturers' Association assembled in convention at the Windsor Hotel in the city of Montreal. The forenoon of the second day was devoted to a trip to Valleyfield, upon invitation of the General Electric Company, of Schenectady, N.Y., the Canadian General Electric Company, of Toronto and Peterboro, and the Montreal Cotton Company, to inspect the extensive works of the latter company. The main object of the visit, however, was to view the magnificent power house and to witness the application of electric power for cotton manufacturing purposes.

A representative of the Electrical News accompanied the party. At 9:00 o'clock a special train of five coaches, furnished by courtesy of the above named electric companies, pulled out of Bonaventure station, and about one hour and a half later the town of Valleyfield, some forty miles from Montreal, was reached. Going direct to the power house, the party was taken charge of by representatives of the General Electric Company and the Canadian General Electric Company, who explained the points of interest concerning the electric plant. Not a few of the cotton manufacturers from the Eastern States expressed surprise at the extensive character, efficiency and economy of operation of the plant, which is one of the most complete in every respect in Canada.

This plant was described in the Electrical News of March, 1897, but since then important additions have been made, the total capacity of the power house being now taken up. Introductory to some brief details of the electric plant, and to give an understanding of the industrial application of the power, it might be stated that the works of the Montreal Cotton Company comprise eight large buildings, none less than three storeys in height and some reaching five storeys. The works are situated on Lake St. Francis, an expansion of the St. Lawrence, on a canal about twelve miles long, excavated by the Dominion government, a dam being constructed between an island and the mainland to maintain a sufficient supply of water in the canal. At this dam a head of fifteen feet at high water and eleven feet at low water is obtainable. For the cotton mills a head race has been excavated 1,000 feet long and tapering from 230 feet at the entrance to 165 feet wide at the exit, the walls being constructed of concrete faced with cement. By the arrangement of the head race the formation of anchor ice has been avoided.

In the power house, a substantial stone structure, 100 x 55 feet, with solid concrete foundation, there are two wheel-pits, each containing four McCormack 60 inch vertical turbines, making eight in all, built by the S. Morgan Smith Company, of York, Pa., each capable of developing 268 h.p. at 68 revolutions per minute under a 13 feet head. The turbines are directly coupled to four separate jack shafts, two wheels to each, placed in two rows extending the entire length of the power house. The wheels are governed by a Replogle's relay governor belted to each jack shaft.



Montreal Cotton Company's Electric Plant.—Two of the 400 k. w. Generators.

THE ELECTRICAL EQUIPMENT.

Directly connected to four jack shafts are four generators of a capacity of 400 kilowatts at 600 volts, of the Canadian General Electric Company's well known three-phase 60-cyle alternating current type. Two of these generators are shown in the accompanying illustration, although it might be erroneously inferred from the illustration that the generators are not parallel in size. For field excitation two 4-pole 17 k.w. machines are belt connected to two of the four generator shafts.

The current is applied directly to the motors without the inter-

position of transformers, and up to date there are about forty of these in use in sizes from 30 to 200 horse power, with several more in process of manufacture. The motors are of the induction type, self starting under all conditions of load, and without collector rings or brushes. At present about 2,300 horse power is utilized to drive electric motors and supply arc and incandescent lighting in all parts of the works. The majority of the motors, excepting those greater than 75 h.p., are suspended from the ceiling on solid supports, thus economizing floor space, and are belted to line shafting, doing away with the long belt drives previously necessary.

In a new mill just completed all the machinery will be operated by induction motors ranging in size up to 250 h.p.

SWITCHBOARD.

In one end of the power house is situated the switchboard, of which a view is shown. It consists of ten white marble panels mounted on an angle iron frame. The two outer panels at each end are the machines panels, each containing the necessary instruments and switches for operating the generators. From the remaining six panels the complete installation of motors and incandescent lights are controlled. If space permitted, more might be said of the interesting features of this switchboard.

DIRECT CURRENT PLANT.

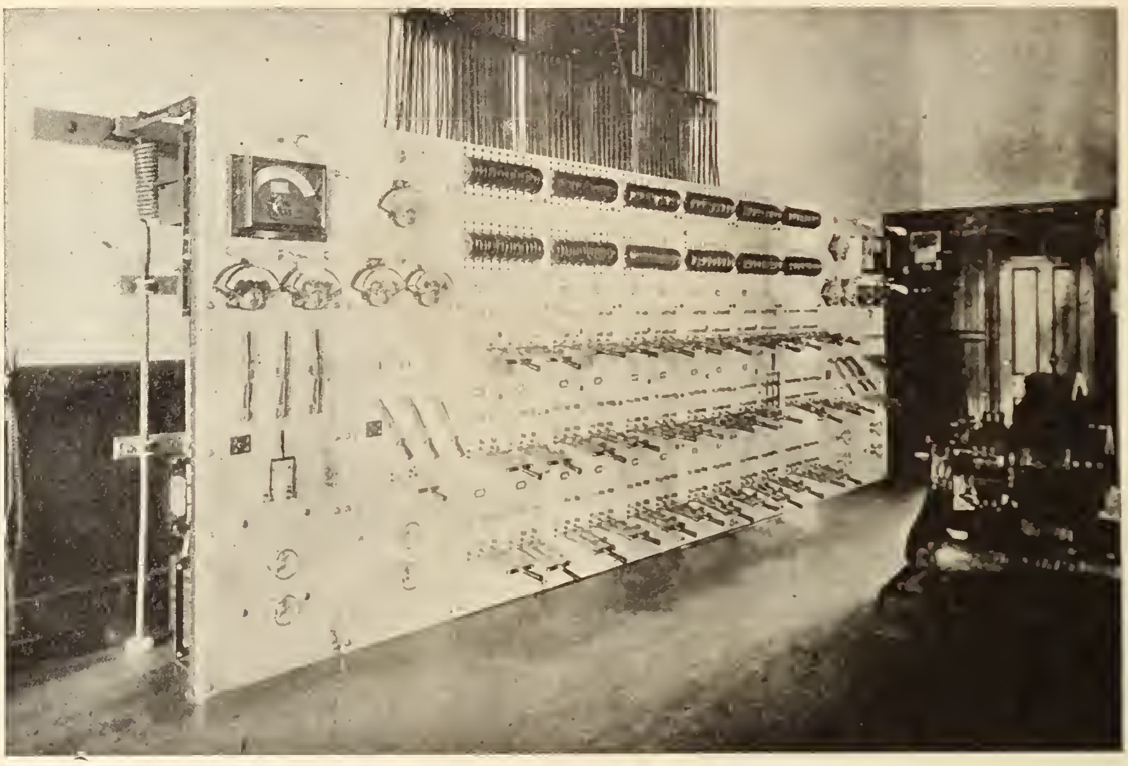
In another building is situated a direct current plant supplying a small portion of the lighting. There are seven Edison generators belt connected to a line shaft driven by a 54-inch vertical Hercules wheel, developing 165 h.p.

PROPOSED ADDITION.

Excavating was in progress for a large extension to the main power house, and it was learned that it is the intention to install two 1200 kilowatt Canadian General Electric three phase generators similar in type to those already installed. These will also be direct connected to McCormack turbines. For this increased installation the head race will be extended and two wheel pits constructed. An extension will also be built to the power house which will contain the switchboard. From this switchboard the entire installation throughout the works will be controlled.

When completed this will be one of the most extensive electric industrial installations on the continent, having a total capacity of 5,400 horse power. The complete electrical apparatus was manufactured and supplied by the Canadian General Electric Company, of Toronto, to whom great credit is due. Prominent engineers have pronounced the use of electricity as applied at the Montreal Cotton Company's works to represent the foremost progress in electrical science.

After a cursory inspection of the manufacturing plant of the company the party were invited to partake of luncheon which had been provided in an adjoining building. About 1 o'clock the train was again taken for Montreal, after the thanks of the association had been tendered to the Montreal Cotton Company General Electric Company and the Canadian General Electric Company.



MONTREAL COTTON COMPANY'S PLANT—GENERATOR AND FEEDER PANELS.

The Standard Chemical Company, of Deseronto, Ont., have recently installed an electric lighting plant in their factories. The apparatus was supplied by the Canadian General Electric Co.

The Canadian General Electric Company are installing one of their standard 120 kilowatt single phase alternators for A. Gagnon & Co., of Victoriaville, P.Q. This is the second machine of this size and type which this company have installed during the past year.

The Toronto Branch No. 1 of the Canadian Association of Stationary Engineers will hold their Thirteenth Annual Banquet at Webb's Parlours, Yonge and Melinda streets, Wednesday evening, October 18th (Thanksgiving Eve). Tickets $1.00; for sale by Committee, A. M. Wickins (chairman), Geo. Thompson (sec.-treas.), G. C. Mooring, J. Huggett, A. Stour, H. E. Terry, and any of the members.

SPARKS.

Mr. J. E. Taylor, manager of the St. Thomas street railway, has resigned and has been succeeded by J. H. Still, president of the company.

The work of preparing to utilise the Boundary Falls water power at Grand Falls, B. C., for electrical purposes has been resumed. Last fall a substantial dam was constructed above the fall, raising the water about 30 feet, added to the head available. Now a tunnel is being driven through the rock which rises sheer above the top of the falls to connect the dam with the flume which is to be built to convey the water to the power house. The tunnel will be 130 feet in length and the flume 1,800 feet, with about 1,100 feet of the latter on trestles. Mr. Francis McLean is in charge of the work. It is intended to use the electric power to be generated for lighting and power purposes, and it is probable that connection will be made with several of the mining camps in the district, so as to supply electricity for mine purposes. At the present time the Mother Lode in Deadwood camp is the only mine in the district using electricity for lighting and blast-firing.

The board of governors of the Hamilton Hospital have appointed Mr. Geo. W. Epps chief engineer.

Mr. R. Anderson, of Ottawa, has purchased a site at Arnprior for his proposed power station for the supply of electricity.

Buffalo capitalists are said to be considering the construction of an electric railway from St. Catharines to Wellandport, Ont.

The council of the town of Newcastle, N.B., is considering the installation of an electric light plant, and may engage an engineer to report on the cost.

The annual meeting of the Montreal Park & Island Railway Co. was held a fortnight ago. The statements presented show a net revenue of $42,997. The old board of directors was re-elected.

Incorporation has been granted to the Midland Power Company, Limited, of Midland, Ont., for the purpose of supplying light, heat and power. James Playfair, Geo. Chew and D. L. White, lumber merchants, are interested in the company.

Messrs. Brewder & McNaughton have issued a writ against the Metropolitan Electric Co., of Ottawa, claiming $50,000 damages for breach of contract and for wrongful deprivation of plant and other material. This is the outcome of a dispute between the contractors and the company, the result of which was that the contract for the construction of the company's works was taken from the contractors.

Mr. Ernest S. Harrison, 191 Thistle street, Winnipeg, Man, has been awarded the contract for the complete equipment of the Hudson Bay Co.'s stores in that city, consisting of one 40 k.w. dynamo direct connected to a 60 h.p. Robb-Armstrong engine, 59 arc lamps and 494 incandescent lights, together with all necessary wiring. When completed this will be one of the largest isolated plants in the west.

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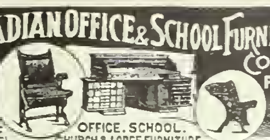

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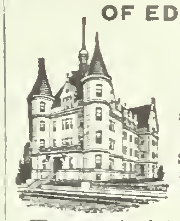

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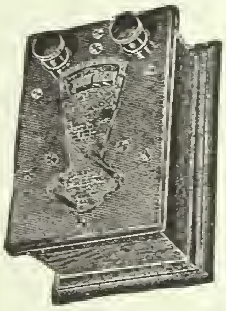

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CANADIAN ELECTRICAL NEWS AND ENGINEERING JOURNAL

OLD SERIES, VOL. XV.—No. 8.
NEW SERIES, VOL. IX.—No. 11.

NOVEMBER, 1899

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CANADIAN

ELECTRICAL NEWS

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VOL. IX. NOVEMBER, 1899 NO. 11.

TWO-PHASE WATER POWER DEVELOPMENT AT SHERBROOKE, QUEBEC.

THE Magog river, its source in Lake Memphremagog, some thirty miles in length and situated high up in the Green Mountains of Vermont, flows in a northeasterly direction, crossing the border between the United States and Canada, finally joining the St. Francis river, one of the numerous tributaries of the St. Lawrence. At the junction of the two rivers Sherbrooke, a city of 12,000 inhabitants, is prettily situated, lying on the banks of both the Magog and St. Francis rivers.

Within half a mile of this junction there is a gradual fall of 110 feet in the Magog, and as there is a plentiful supply of water throughout the entire year, this convenient and economical power is utilized to a great extent in supplying many industries, of which the principal are woolen, grist and saw mills, iron works, a carpet factory, the water works and the street railway and electric light plants. Though the head obtainable for each mill varies to a large extent, yet the average is about 24 feet.

Though it might be profitable from an hydraulic standpoint to investigate the method employed by the various mills to develop the water power, we must content ourselves with a brief description of the electric light and power plant, its power development, its equipment and distribution.

This electric light plant, as it is still called, was installed in 1889 by the Sherbrooke Gas & Water Company, which at that time operated both the gas and water works, as its name implies, but which has since disposed of the latter to the city, still retaining the gas works, together with the electric plant. Here we find one of those rare cases where the gas and electrical interests do not conflict. In all the latest buildings being constructed the electric light is installed to the exclusion of gas, which is now, however, much used for heating purposes, taking to a great extent the place formerly occupied by the coal stove.

Since its inception the electric plant has undergone many changes. It first started with but a few lights run on the single-phase alternating current system. After increasing in common with all other similar plants, machine after machine being added when neces-

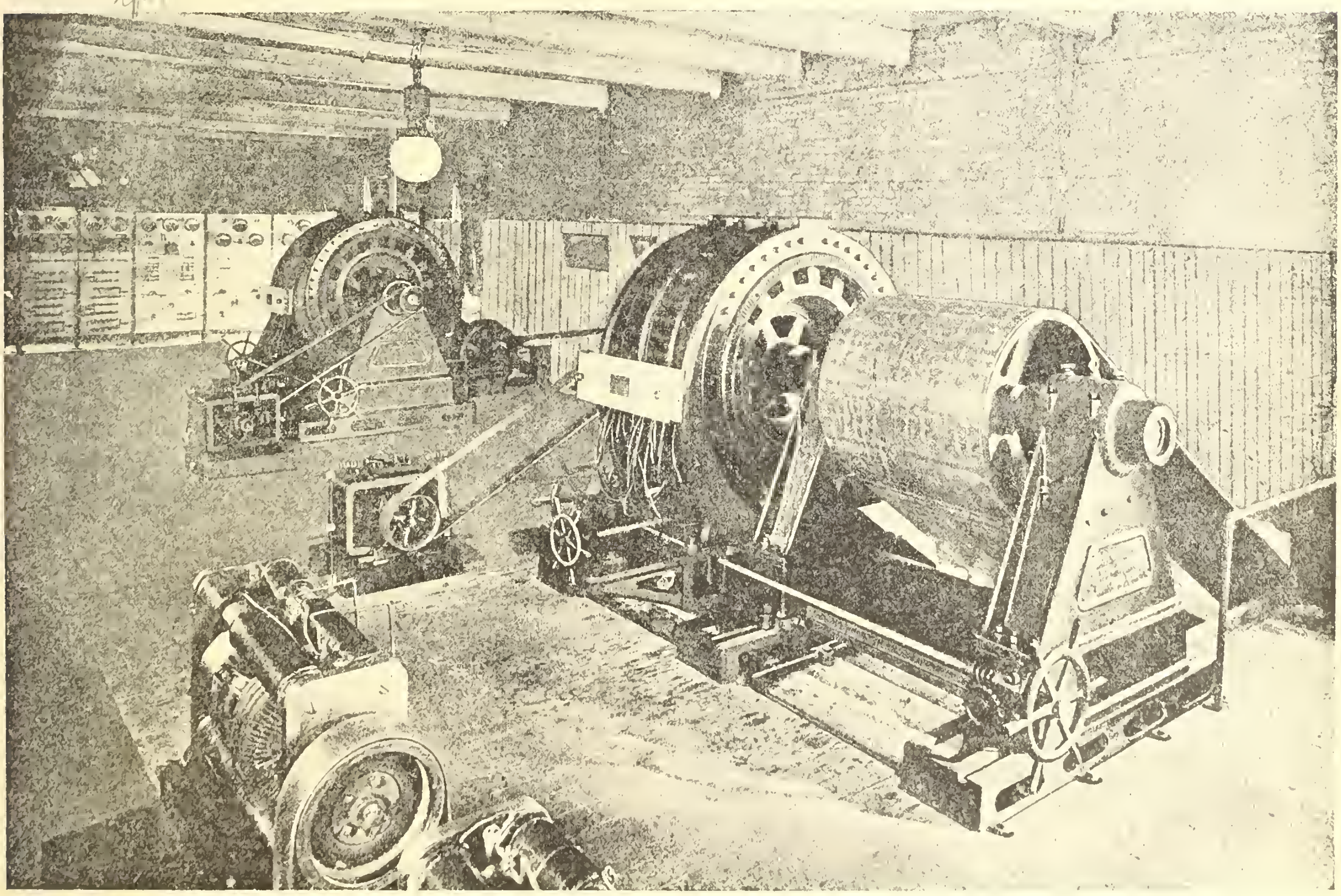


FIG. 1.—INTERIOR OF POWER HOUSE.

sary, a radical change was made in 1897 by the adoption of the two-phase system using S.K.C. machines, which have been in operation ever since for both light and power with excellent results.

WATER POWER DEVELOPMENT.

One of the numerous small falls on the Magog has been utilized as a head for the power required. By reason of a natural dam extending across the river at this point between the two rocky cliffs composing the river banks, but a comparatively small outlay was necessary to control, store and utilize the otherwise wasted potential energy of the water.

The river flows through a narrow rocky gorge some 200 feet wide, the sides rising very abruptly, almost precipitously, from the river bed, which is nothing but solid rock. The natural rock dam extended almost entirely across the river at the point selected for the head race entrance, and all that was required was to erect a wing dam and thus direct the flow of the water and also to store it.

The inner side of the head race is the abrupt bank of

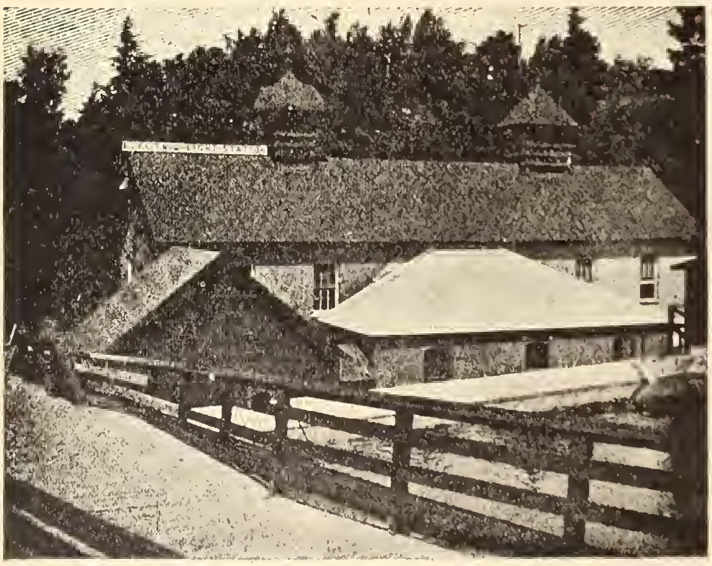
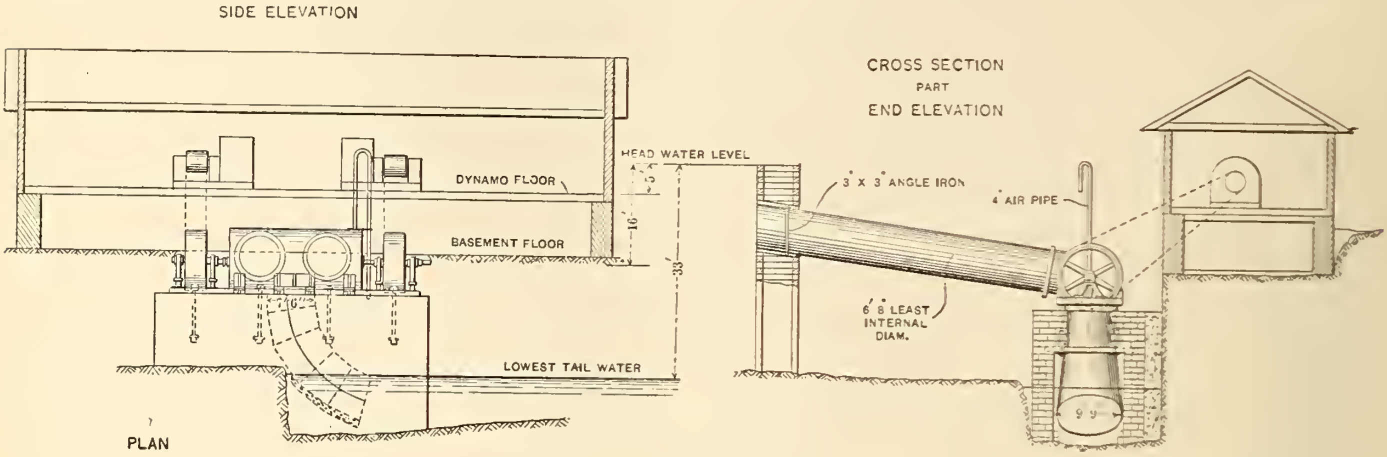


Fig. 2.—Power House.

he stream, some blasting being necessary for the removal of the projections and the large boulders to make it conform to the required conditions for service. The outer side is constructed entirely of timber, the main supports being 10 inch by 10 inch spruce faced with 3 inch plank on the inner side, which slopes diagonally into the head race such that the weight of the water itself provides the required stability. The form of this retaining wall is thus a right-angle triangle, the vertical side varying in height from 8 feet a the entrance 3 feet at the extreme end of the head race, while the base varies correspondingly.

The head race is 300 feet long and varies in width from 50 feet at the bulkheads to 150 feet at the entrance, the breadth of the river; in depth it is 5 feet at the entrance, increasing somewhat as the bulkheads at the far end are reached.

The velocity of water in the head race is 4 feet per



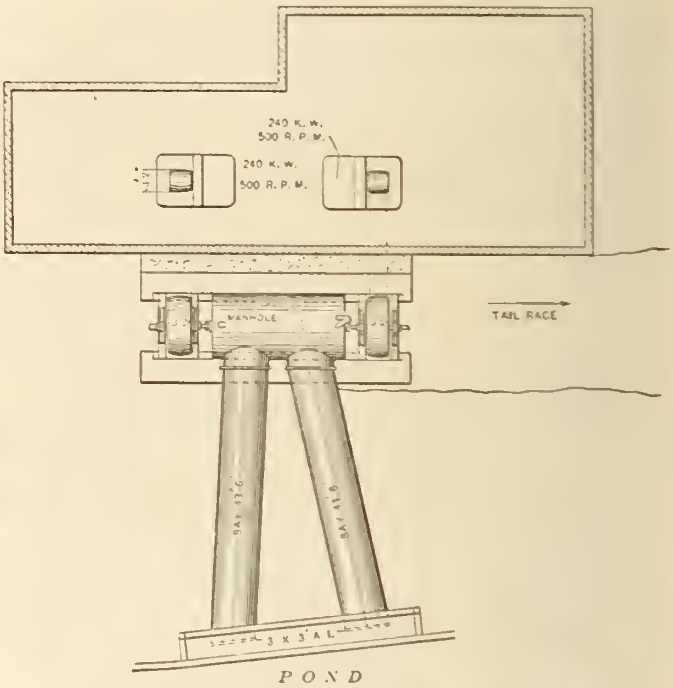


Fig. 3.—Plan, Elevation and Section of Power House.

second, and it is consequently never frozen over even during the most severe weather in winter. Strange to relate, no great difficulty has been experienced with either frazil or anchor ice, never yet necessitating the shutting down of the plant for a moment. There is, of course, a certain amount of frazil at times, as in all running water exposed to intense cold, but not enough to do any damage, and during severe weather men are always stationed at the two racks to prevent the accumulation of ice, slush or rubbish, which they remove with rakes through small waste gates in the side of the head race or over the sloping sides. There are two racks placed 100 feet apart in the head race to prevent ice of any description, logs or floating debris passing through to the wheels.

Situated at the lower end of the head race are two gate houses serving as intakes or entrances to the three pipes or flumes carrying the water to their respective turbines in the power house. In each gate house there are wooden gates which may be

closed when necessary to stop the flow of water in the flumes.

The first flume is a ¼ inch steel pipe 6 feet 6 inches in diameter, composed of 6 foot lengths securely riveted together; the whole flume from gate house, where there is a one-eighth turn elbow located, to the wheel case, to which it is riveted, is 50 feet long. The remaining two flumes are also ¼ inch steel, 6 feet 8 inches in diameter, 50 feet long, running side by side in a straight line to the wheel case situated in the power house. A view of this when under construction is shown in Fig. 4. The weight of these massive pipes is supported by two large masonry piers in which they are imbedded to about one-quarter of their diameter. Expansion or contraction is neglected, as it is inconsiderable in such a short length of pipe, besides which the water inside is flowing continually and the heating or cooling effect of the atmosphere on the pipe is thus reduced to a minimum.

TAIL RACE.

The tail race, a great portion of which has been blasted out of the solid rock, is directly beneath the bulkhead, and lying between it and the power house. A winter view of this and also the bulkhead and pipe line is shown in Fig. 5. It is 140 feet long and 40 feet wide, the discharge flowing away into the river, where it undergoes a similar process farther down, being utilized again and again for power purposes.

A wing dam constructed of rock and of the shale removed during the process of blasting separates the tail race from the river, and 5 feet higher than the level of the tail race, thus preventing it being submerged by the river even at high water.

The draft tube, 7 feet in diameter at the top, extends down vertically a few feet from the large wheel case, then gradually making a quarter turn, discharges into the tail race in the direction of flow, its diameter here being increased to 10 feet. A deep hole was excavated in the tail race to accommodate this huge pipe, keeping it continually submerged, so that no air could possibly enter to destroy the head produced by the vacuum due to the rapidly descending discharge water. The greatest available head is 34 feet, which is one very desirable for facility and economy of operation.

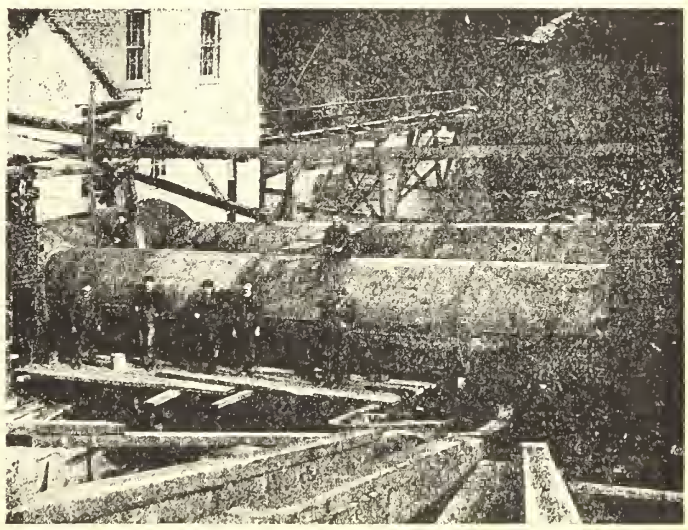
POWER HOUSE.

Nestling in the chasm between the precipitous banks of the river is a small rocky island, and here is the location of the power house, a one-storey brick building 80 feet long by 26 feet wide (Fig. 2). The foundations are of solid masonry resting on the bedrock.

The framework is of wood, the timbers being very massive; the floors are of very thick hardwood planking supported by wooden beams; the roof is also of planking, but is covered with iron sheathing.

The hydraulic equipment consists of three turbines, having a total capacity of 1,730 h.p. The first is a 54-inch "New American" vertical turbine capable of developing 535 h.p. at 124 r.p.m. under the normal head of 30 feet obtained at this point; this head may be increased at any time by carrying the tail race excavations further up, and so obtaining almost the whole 34 feet, which is used at the other wheels only some 20 feet away. This wheel was manufactured and supplied by Wm. Kennedy & Sons, Owen Sound, Ont., the Canadian agents and manufacturers for the Dayton Globe Iron Works Company, of Dayton, Ohio. From a horizontal pulley connected to the vertical turbine shaft by means of a mortise bevel gearing, a generator in the dynamo room is belted.

The remaining two are each 40-inch "Crocker"

FIGS. 4 AND 5—VIEW OF TAIL RACE AND FLUMES.

wheels of the horizontal type, both placed in one case, a huge steel cylinder, 10 feet in diameter and 22 feet long, fed by the two steel flumes (Fig. 1). Being inward flow turbines, the water enters at each end of the case, and rushing inwards towards the centre, strikes the wheel vanes, the thrust of each wheel being equalized by the other. Being then deprived of its energy, the water falls inert into the draft tube, and, descending vertically, discharges into the tail race. This draft tube has a vertical height of 17 feet above the tail race, and the head over the wheels is also 17 feet, thus producing an available head of 34 feet, at which each wheel is capable of developing 596 h.p. at 180 r.p.m. Two overhung pulleys, one at each end of the wheel case, supply power to two generators in the dynamo room by means of two immense leather belts; an adjustable belt tightener is used to take up all slack. A plan and elevation of the power house (Fig. 3) will show the above arrangement. The two "Crocker" wheels, with wheel case, steel flumes and draft tubes, were manufactured and installed by the Jenckes Machine Company, of Sherbrooke, Que.

The gates on all three wheels are of the "register" type, which, on opening or closing by some regulating device, control and adjust the quantity of water striking

the vanes of each wheel. The regulating device, by means of which the gates are opened or closed according to the variation in the speed of the generator, is a "Replogle" electro-mechanical governor, manufactured at the Replogle Governor Works, Akron, O. There are two of these governors, one for each water wheel unit—one for the "New American" and the other for the two "Crocker" wheels, the gates of both wheels being operated to the same degree at the same instant, as both are in the same wheel case.

The electrical equipment consists of two 240 k.w. two-phase S.K.C. generators belted to the "Crocker" unit, one 180 k.w. two-phase S.K.C. generator and three 35-light "Ball" arc machines, all belted to the "New American" wheel.

The two largest machines (Fig. 1) are placed on concrete foundations 20 feet high resting on the bed rock beneath, and operate at 500 r.p.m., delivering current at a pressure of 2,400 volts direct to the line with a frequency of 133 cycles per second. The 180 k.w. two-phase generator has the same voltage and frequency, but is run slightly faster—at 660 r.p.m.

Belted to the shaft of each of the three generators is

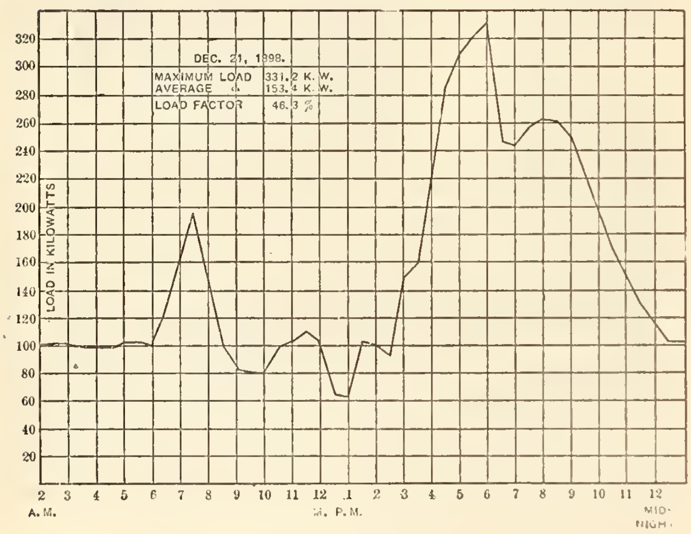


FIG. 6—LOAD CURVE, DEC. 21, 1898.

an 8 k.w. 4-pole exciter, each of which is capable of fully exciting the entire plant.

All the S.K.C. apparatus, generators, switchboard and instruments were manufactured and installed by the Royal Electric Company, of Montreal.

There are three 35-light arc machines, made by the Ball Electric Company, of Toronto, in use at present, but these will shortly be shut down and the present system of direct current series arc lighting changed to the enclosed alternating current arc lamp system run from constant current transformers, so that power, incandescent and street lighting will all be operated from one machine, thus making an ideal arrangement.

SWITCHBOARD.

The switchboard, a view of which may be seen in Fig. 2, consists of eight white marble panels mounted on a solid white oak frame, presenting a handsome appearance. It is situated at the end of the dynamo room.

The first three panels to the right are solely for the machines, while the remaining five are the distributing panels for the various feeders ; each panel is one huge slab of Vermont white marble.

The machines are not operated in parallel, but are run separately, the load being divided between the machines in operation in proportion to their respective capacities.

The first three panels, which are the three generator panels, are similar to each other, except that the third contains an S.K.C. static ground detector and switch for connecting any line to ground, hence a description of one applies to all. Each machine panel contains the following apparatus in the order named, starting from the top of the board : A voltmeter, which, by means of a small switch placed underneath, reads the pressure on either phase ; two ammeters, one in each phase ; two double-pole high potential S.K.C. slide switches, one in each generator phase ; two regulator heads, one in each phase ; a double-pole, double-throw switch such that either of two exciters may be used to excite the field of any generator ; and lastly, a generator and an exciter field rheostat. The regular heads in each phase act to vary the machine voltage by causing some small armature coils in the machine to act either in conjunction with or in opposition to the main armature coils, thus raising or lowering the voltage. For this purpose it is, of course, necessary to run the terminals of each coil to the regulator head on the switchboard, though in a small machine the regulator heads are placed on a terminal board on the machine itself. The maximum variation in the primary voltage obtained by means of this regulator head is 200 volts on each phase.

Each of the five feeder panels is but a repetition of the other, so that a description of one will suffice. The first two panels are for the incandescent lighting circuits only, while the remaining three panels are for combined light and power from the three-wire two-phase distribution used. Each of these panels, then, contains the following apparatus, viz.: Two ammeters, one in each phase or circuit ; two S.K.C. circuit breakers, also one in each phase, and four double-pole double-throw switches such that any circuit on the lighting panels may be placed in either phase of either generator.

The indicating instruments are mostly of the Royal Electric Company's round type, though some few of the Whitney make are used.

DISTRIBUTION.

From the switchboard the various feeders pass through two cupolas in the roof to the poles, where current is then distributed in the city on the three-wire two-phase primary system, and transformed down to 104 volts for light and power service by means of transformers banked in as large units as may be economically used to supply all the customers in that immediate vicinity. The ordinary four-wire two-phase secondary distribution is used exclusively.

Though no lightning arresters nor choke coils are placed in the power house, there are no less than twenty sets of two S.K.C. non-arcing lightning arresters located at various points on the line, to which taps from the service wires are taken, the ground wire being No. 4 B. & S. As an extra precaution, a barbed wire is run along the top of the poles and grounded at every fifth pole in one section of the city.

There is a short transmission line to Lennoxville, a town of some 2,000 inhabitants, situated four miles away, where both light and power are supplied.

The poles for this line are similar to those used in the city, perhaps somewhat shorter, and are of white cedar, 35 feet long, 7 inches in diameter at the top, embedded 5 feet in the ground, and are spaced 100 feet apart.

The three-wire two-phase line consists of two No. 2

B. & S. and one No. 1 B. & S. weather proof insulated copper wires placed on double petticoat glass insulators, thirteen inches between wires. A transformer is used as a booster to raise the potential on this line a slight amount, such that the voltage at Lennoxville will be the same as in the city ; that is, the amount boosted will represent the line drop, which is in this case a very small amount.

This plant is in operation continually, suffering no interruptions. A load curve is shown in Fig. 6. There are some 6,500 16 c.p. incandescent lamps and about 150 h.p. in induction motors in various sizes installed, and, as previously stated, by the time this goes to print there will be a system of 100 enclosed alternating current arc lamps of the General Electric type for street lighting, supplied from the regular circuits by means of constant current transformers.

Current is sold both by meter and by the flat rate, some 300 meters being already installed. For incandescent lighting the rate is one-half cent per ampere hour, after deducting the usual discount allowed for prompt payment, a 3½-watt lamp being used. The flat rate is $6 per 16 c.p. lamp per year, with a sliding scale of prices for large consumers. For power the rate varies from $70 per h.p. year in small units to $30 per h.p. year for larger sizes, such as 30 h.p. and greater.

The officers of the Sherbrooke Gas & Water Company are : Mr. R. W. Heneker, president ; Mr. E. F. Waterhouse, secretary, and Mr. A. Sangster, electrical engineer and general superintendent.—E. M. Archibald, in Electrical World.

BY THE WAY.

WHAT is claimed to be the largest electric sign in Canada attracts the attention of passengers on the Grand Trunk west bound trains as they approach the little village of Acton, Ont. This sign stands on the coping of the factory and reads : "W. H. Storey & Son, Glove Manufacturers." It is over 50 feet from the ground and 100 feet in length. Each letter is three feet in height and of corresponding width, and 340 incandescent lamps, designed to give the most brilliant effect, are required to properly light it. The current is supplied by a dynamo on the premises, and the work of wiring and installing the lamps was done by Mr. Kitchen, electrician in charge of the municipal plant. The brilliancy of the sign is a splendid example of the usefulness of electricity for advertising purposes.

× × ×

SOME time ago trouble developed on the arc light circuit at the Union Station, Toronto. The electric light company's officials went carefully over the circuit and examined with the closest scrutiny every joint, without finding any defect which would account for the failure of the lamps to operate. While walking about the building with eyes alert to discover any clue which might assist to solve the mystery, the official's attention was attracted to the peculiar conduct of a man in the barber shop, who was gazing intently at the lamp overhead. In answer to a question as to the object of his interest, he replied that he had invented and was testing a new kind of arc light carbon, "and," he added enthusiastically, "I'm satisfied it will be a success." Here then was the solution of the mystery. The ingredients in the new style carbon were not of a kind to permit the passing of the current to the lamps beyond. In the absence of a stenographer there is no actual record of the language employed by the electric light official towards the enterprising inventor, but it is said to have been delivered at a very high voltage and not intended for publication.

ALUMINUM WIRES.

IN a recent comment on the proposed use of aluminum wires in connection with the electric transmission line from Ragged Rapids to Orillia, Ont., the fact was mentioned that in like manner in only one other instance was aluminum being similarly employed, viz., in the new transmission plant at Snoqualmie Falls, 31 miles distant from Seattle and 45 miles from Tacoma. From a description of this plant appearing in the Electrical World and Engineer, the following particulars are extracted regarding the transmission lines, for which aluminum wire is exclusively employed :

The transmission circuits are led from the transformer house over a rough but not mountanous country to a sub-station at Issaquah, 10 miles distant, the lines paralleling each other at a distance of 40 feet. These parallel lines continue to Ranton, a further 9 miles, where current is used locally, and from that point branch to the north-west and south-west to Seattle and Tacoma.

Aluminum wires have been used on these long distance transmission circuits of No. 1 and 2, B. & S. guage. Line conductors are spliced with the McIntyre joint, consisting of a flattened aluminum tube 9 inches long, with walls 1-16 inch thick, large enough to enclose two wires. The latter is given three complete twists by special clamping tools to complete the joint (Fig. 1). The Seattle line contains about 67,000 pounds of aluminum, and the Tacoma line 72,000 pounds, each

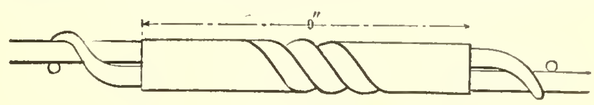


FIG. 1.—ALUMINUM WIRE JOINT.

line consisting of two three-phase circuits. The conductors are carried on triple-petticoat "Imperial" glazed porcelain insulators, 4½ inches high, 6½ inches in diameter, weighing 4 pounds each. Paraffined locust pins are used to support the lower part of the insulator 4 inches above the cross arms. The tie wires are of No. 3 aluminum.

Two circuits are run on each pole line, one on each side, with triangular space of 30 inches between wires (Fig. 2). Four wires on the lower cross arms are

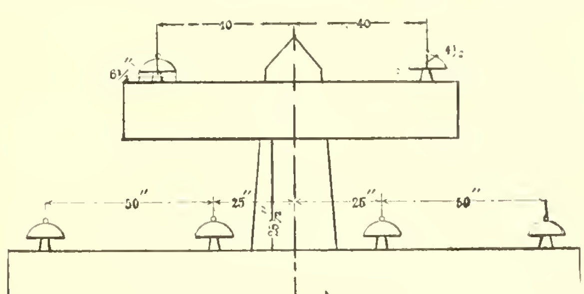


FIG. 2.—LOCATION OF CIRCUITS ON POLES.

spaced on either side 25 inches and 75 inches from the centre of the pole ; 25½ inches above on another cross arm are two wires, 50 inches on either side of the pole. The length of span on the Seattle lines varies from 90 to 150 feet, with an average of 110 feet. On the Tacoma line the average span is 150 feet.

The behavior of the new conducting material when this plant goes into operation will be watched with particular interest.

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Door Keeper, WILLIAM BEAR,	Dresden, Ont

A Nice Point in Law. The courts will shortly be called to decide a fine point of law in connection with the appeal which has been filed by the Montreal Street Railway Company against the assessment which the city seeks to impose on the company's poles, wires and rails. The valuation for assessment purposes put upon this portion of the company's plant is $280,000. The assessment is made under article 361 of the City Charter. The company in their appeal have pointed out that, while authority is given, under the above mentioned article of the City Charter, to tax poles, wires and rails of the company, this article is a violation of article 567 of the charter which provides that the city shall not be allowed to violate any of its obligations undertaken by contract. The contract between the city and the company stipulates that a percentage of the earnings of the railway shall be paid to the city in lieu of taxes, except taxes on real estate. The company state that, in accordance with this provision, the city have accepted a percentage on the earnings of the company in lieu of all taxes and assessments, with the exception of the tax on immovable property which was immovable at the time of the making of the contract. The company express their willingness to pay taxes on their lands, buildings and machinery. The courts will be asked to decide the question.

The American Street Railway Association. THE eighteenth annual convention of the American Street Railway Association, which opened in the city of Chicago on October 17th, was in some respects one of the most successful yet held. The attendance was unusually large, and while but four papers were presented, their reading and discussion brought out many interesting and suggestive points. A noticeable feature of the convention was the consideration given to the labor question and the method of manipulating employees. Mr. Vreeland characterized the question as one requiring a great deal of energy and ability, but which if satisfactorily handled was one of the greatest elements of strength in street railway management. An argument was advanced in favor of employing young married men. A question affecting street railway practice was brought up by Mr. Heft, who made the statement that in looking up the matter of weights he had found that for every passenger hauled with a modern street railway equipment 721 pounds of dead weight were also hauled, which is only 137 pounds less than the standard steam railroad equipment. It was pointed out that street railway managers might with advantage turn their attention to effecting a reduction in the weight of equipment. The respective merits of single versus double motor equipments formed an interesting discussion, the consensus of opinion being in favor of cars equipped with two or more motors. The objection to single motors was the greater cost for repairs and insufficient tractive power. "The Construction and Maintenance of Street Railway Tracks" was treated in a paper by Mr. Edward Butts. He advocated that the rail should be not less than six inches in depth, the rail trench 20 feet wide at the top and 6 inches wide at the bottom, and that cast-welded joints be used. This latter recommendation created considerable discussion, inasmuch as it is a comparatively new practice in street railway construction. Mr. Heidelburg, of Chicago, said that the Chicago

City Railway Company was the second company to use the cast-welded joints, and that they had given excellent satisfaction. It might be mentioned that the Montreal Street Railway Company have lately adopted this class of joints on a portion of their road, and that the directors have recommended that it be applied to the entire system. There was present at the convention the following representatives of Canadian street railways: J. B. Griffith, manager, and C. K. Green, director, Hamilton Street Railway Company; E. H. Keating, manager, Ewan Mackenzie, assistant superintendent, and P. McCullough, electrician, Toronto Street Railway Company; Duncan McDonald, superintendent, H. A. Brown, electrician, and W. A. Ross, comptroller, Montreal Street Railway Company.

Wireless Telegraphy.

The employment of Mr. Marconi by the New York Herald and the Chicago Times Herald, to report, by means of wireless telegraphy, the recent International yacht race, has given a further demonstration of the practicability and value of this important discovery. By means of the Marconi system messages were transmitted from the vessel on the race course to the city of New York within periods of one-half to two minutes, to Chicago within seven minutes, and to London within fifteen minutes. In other words, the system effected a saving in time, as compared with dispatch boats, of fully an hour. On another page will be found a very clear and concise description of this system prepared for the New York Herald by Mr. Marconi's assistant, Mr. Broadfield. We are pleased to observe that the British Goverment are said to have arranged to make use of the Marconi system in connection with the war which is at present in progress in the Transvaal. It would appear that the system might there be employed to great advantage in view of probable interference on the part of the Boers with the telegraph system. Notice has recently been given in the press of an action which has been entered against Mr. Marconi by Professor A. E. Dolbear, of Tufts' College who claims to be the original discoverer of space telegraphy, and who is said to be in possession of broad patents covering the transmission of messages without wires. Professor Dolbear is not likely to receive much sympathy in connection with the step which he is said to have taken. If, as far back as 1885, he demonstrated the practicability of telegraphing without wires, has allowed the important discovery to remain unutilized until the present, and has left to another the task of proving its commercial value, he is deserving of none of the rewards.

Private vs. Municipal Control.

The city of Austin, Texas, furnishes what may be termed a horrible example of municipal control of electric lighting. In 1890, the city decided to discontinue the arrangement under which the public lighting had been done by a private company at a cost of $18,000 per year, and adopted the project of constructing a gigantic dam across the Colorado river, three miles west of the city of Austin, by which it was expected that some 14,000 horse power could be developed and utilized for lighting and power purposes. The expectation was, that when this water power was made available, the city would become a great manufacturing centre, and the authorities had probably in view the idea of securing the lighting of the streets at little or no expense. The ratepayers, with these arguments before them, sanctioned the issue of bonds, bearing interest at five and six per cent. repayable in forty years, for the sum of $1,750,000, to cover the cost of construction of the works. The project has resulted in total failure both as regards the engineering work and the commercial results. Since its construction, serious leakages have taken place below and beneath the dam resulting in the lowering of the water to such an extent that very little power is now available. Apart from this is the serious fact that not a single manufactory has been brought to the city as the result of this power, so that the total expenditure has been practically thrown away, and the city finds itself placed under a burden of operating expenses and interest charges amounting to $174,000 per year, against which the revenue is only $60,000 per year. Added to this is the fact that sufficient power cannot be obtained, and the installation of an auxiliary steam power plant is now under consideration. The undertaking will probably bankrupt the municipality.

In connection with this subject of municipal control, we observe that the National Electric Light Association submitted a proposition to the League of American Municipalities at its recent convention in Syracuse, New York, to pay one-half the cost, not exceeding the sum of $5,000, to investigate and determine the cost of operation of five municipal lighting plants. The Municipal League accepted the proposition with the amendment added that the investigation should also include five private plants. It was pointed out that this amendment would prevent the carrying out of the proposition, as no one had authority to give the privilege of examining private plants, and owners of such plants could not be expected, under present circumstances, to disclose particulars of their business. The manager of a Canadian electric lighting company was asked by the National Electric Light Association to state what amount his company would be willing to contribute towards the cost of the proposed investigation. He laconically replied, "Not one cent," and proceeded to give the reason for his refusal, viz: That as a rule the promoters of municipal control of electric lighting do not look at the question from the standpoint of economy of the public funds, the aim being rather to obtain a larger control of public patronage to their own advantage and the advantage of their friends, and that therefore no figures which could be published showing from an economical standpoint the disadvantage of municipal control would have any effect in checking the agitation for munibipal control. A proper method of procedure is the one which was also made at the Syracuse convention, namely, that the legislatures should make it compulsory upon the management of all public utilities to present detailed annual statements in such form as would permit of comparison being made between the items of expenditure of the different plants whether operated by the municipality or by private companies. We are in accord with Mr. Francisco's statement at this convention, that the remedy is not municipal ownership but regulation. So far as Ontario is concerned, the Conmee Bill passed at the last session of the legislature is well calculated to protect the interests both of municipalities and lighting companies, so that the situation in this province is much improved as compared with the conditions which prevailed prior to the passing of this enactment.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, October 30th, 1899.

ELECTRICAL DINNER.

THE first annual dinner of the Y. M. C. A. Electrical Club was held on Friday, September 29th, in the Association building, at which there was a good attendance of members and their friends The menu was as follows:

MENU.

ELECTRIC JUICE.
OYSTER SOUP, Fresh Malpecque.
A la Submarine.
BOOSTER.
CHICKEN PIE.
A la Micro Farad.
JOINTS, SOLDERED AND TAPED.
ROAST BEEF.
Leather Belting.
ROAST TURKEY.
Carbon Trimmed.
SHUNTS.
MASHED POTATOES. SWEET CORN.
Grounded. Dismantled.
LOBSTER SALAD.
A la Accumulator.
ISOLATED PLANT.
CELERY.
DESSERT.
INSULATING COMPOUNDS.
CHARLOTTE RUSSE. JELLY.
ASSORTED CAKES. Multiple Series.
ICE CREAM. WATER ICE.
Self Cooler. A la Frazil.
FRUITS.
PEARS, APPLES, GRAPES, BANANNAS.
INTERNAL RESISTANCE.
CHEESE. CRACKERS.
TERMINALS.
LEMONADE. CAFE NOIR.
50,000 Volts. High Potential
Are You Finished? Ring Off. Transfer. "30."

The chair was occupied by the president. Mr. F. B. Horn, who explained that the object of the club was to visit electrical plants and to promote the social and educational welfare of the students of the electrical class in connection with the educational depart-

PROF. L. A. HERDT, E.E., Ma.E.,
Honorary President Y. M. C. A. Electrical Club.

ment of the Y. M. C. A. There were two main toasts, that of "Electricity" and "Our Association," which was responded to by Prof. Herdt, lecturer in electricity at McGill University, and honorary president of the club, and Mr. D. A. Budge, secretary of the Y.M.C.A. "The touch of electricity," said Prof. Herdt, "makes a great city. Take, for instance, the street railway power house, with its dynamos generating 10,000 horse power. Think of 10,000 horse power under one roof, saddled and ready for a start. Electricity has changed the manners and the customs of mankind."

Mr. D. A. Budge, on behalf of the Association, gave an instance of the value to the members of the evening educational classes. He knew of a young man engaged in the G. T. R. shops who took up the study of mechanical drawing, acquiring knowledge that soon secured his advancement. At the time of the United States declaration of war with Spain, the Baldwin Locomotive Works, of Philadelphia, were under contract to equip a railway in the northern part of Spain, and had already shipped the locomotives. They did not wish, under the circumstances, to send a United States citizen to equip the road, and applied to the G. T. R. for a Britisher. The young man above referred to was sent and accomplished the work. On returning, he was sent to Cuba to report on the condition of locomotives wrecked in the Cuban war. Mr. Budge said that he became acquainted with these facts by a chance meeting with the young man on a recent holiday trip, the latter being then bound for South Africa to set up fifty locomotives for the Baldwin Company. He remarked to Mr.

MR. F. B. HORN,
President Y.M.C.A. Electrical Club.

Budge that the improvement of his time in the evenings had had much to do with his promotion.

The secretary of the club, Mr. J. F. C. Bray, gave a resume of the summer's work, which included lectures on "The Theory of the Telephone," by Fred B. Horn; "Interior Wiring," by T. F. Pickett; "The Electric Motor," by Prof. Herdt. Visits to the electrical plants were also made.

During the evening a programme was contributed by the following gentlemen: Mr. Crawford Grantham, piano solo; Mr. A. F. Cameron, song; Mr. R. H. Gibson, recitation; Mr. W. R. Wilson, song; Mr. Will Sutton, selections on the gramophone. The

MR. J. F. C. BRAY,
Secretary Y.M.C.A. Electrical Club.

evening's enjoyment was brought to a close by the members joining hands and the hearty singing of "Auld Lang Syne."

INTERIOR WIRING.

Nearly every illuminating company in Canada, and in fact in the neighboring republic, have given up doing interior wiring. The Royal Electric Company, of Montreal, however, are unique in this respect, inasmuch as they still tender for such work. In a great measure success in this line depends on how the superintendent of that branch handles his customers. The Royal Company have a man who can do this to perfection, giving courteous

treatment all round, looking to giving satisfaction in the work, and also after the interests of his employers. Such is Mr. J Douglas, in charge of the wiring department of that company. That he has had training in other branches of electric construction, from the common house bell to telephone and telegraph systems, no doubt forms a valuable auxiliary when looking after "trouble." He seems the right man in the right place, and would be hard to replace.

AN UNPROFITABLE PURCHASE.

A certain professional gentleman was prone to purchase in the United States some nice running motor, projecting arc light, etc., which might be useful to him in his business, only to find that the alternating current in use in Montreal was not healthy for the instruments when connected upon their arrival. Professional men are the first to complain if their patients do not take them into their confidence; the local electrical fraternity may well say ditto. By a little consultation, the fee not being forthcoming as in the professional man's own case, he might have been saved a few almighty dollars.

"TRAMP ELECTRICIANS."

A nuisance has developed in Montreal, in the shape of miscreants who detach incandescent bulbs from corridor and hall brackets in public buildings and purloin them. As free renewals are given by both the Royal and Lachine companies, and as such lamps are not offered for sale so that the offender might be apprehended, it is to be inferred that these lamps are appropriated by "tramp" electricians who carry their office, etc., in their hat. They know the value of the goods, and can use them in their work. No wonder the legitimate business cannot tender against these gentry, and it is an injustice for any architect or citizen to employ such.

NEW BUILDINGS.

The new factory of Messrs. Tooke Bros., now being erected at St. Henri, near Montreal, will be well equipped electrically. The plant will consist of two new 54 k.w. generators, to be run on the three-wire system, supplying from an up-to-date switch-board of blue Vermont marble 900 incandescent lights, three 15 h.p. motors, two 8 h.p. motors, one 6 h.p. motor, and one 5 h.p. motor. There will also be a heating plant separate, consisting of their present factory generator and 60 enamel pattern sad irons. The new switch-board and generators will be supplied by the Canadian General Electric Company, as well as the 15 and 8 h.p. motors. The wiring and construction work is in the hands of the Montreal Electric Company.

The new Mount Royal Club building is probably the most exclusive as well as the most elaborate in Canada. It is the house built by the late Sir J. J. C. Abbott, used by Lord and Lady Aberdeen as their vice-regal residence in Montreal, and now entirely remodelled and extended by Messrs. Maxwell & Shattuck, architects, to suit the views of the gentlemen of the Mount Royal Club, who are some of the wealthiest in the Dominion. The wiring was done by Messrs. Lewis & Co., of Boston, and the fixtures specially designed by the architect and manufactured in the United States. They were hung and connected by the Montreal Electric Company.

The conduit for the new building of the Merchants' Bank of Canada in this city has just been installed, construction being by the Montreal Electric Company. The plant will be two wire, at 220 volts, and is thought to be the first of its kind here using 220 volt lamps. Although not at first contemplated, it is the intention to have their own private plant. The Royal Electric Company have been successful in securing the order for generators and switchboard. Sprague electric elevators will be used, supplied through the Montreal agents, Messrs. Jack & Robertson. The architects are Messrs. Maxwell & Shattuck.

MUNICIPAL REGULATIONS.

The proposed new building by-law for the city of Montreal contains the following regulations governing the installation of electrical apparatus:

All the electrical apparatus, wires, etc., for the generation or supply service in any central station or isolated plant, and all wires, lamps, motors, etc., used for light, power or heat in any public or private building, shall be installed according to and in conformity with the rules and regulations of the Canadian Association of Fire Underwriters, and in order to secure conformity to said rules and regulations, all such installations shall be subject to inspection and issuance of a certificate to that effect from the electrical inspection department of the city of Montreal. In order that proper inspection may be made, due notice shall be given the building inspection office of any intention to install any such electrical wires or apparatus for the purposes herein mentioned, in order to allow of inspection of the installation as the work progresses, and before any portion of the work is covered or concealed, and no installation shall be considered complete and in conformity with said rules and regulations until a certificate shall issue from the inspection department to that effect. In all cases, the inspection department shall have power to decide and determine whether such work has been done in a safe and proper manner, and the issuance of a certificate therefor shall be in evidence thereof.

All materials, switches, wire or any other auxiliary apparatus or device pertaining to said installations shall be subject to the inspection department before being used for such purpose.

All wires of any description, either for telegraph, telephone, electric light, heat or power, on, or entering any building, public or private, shall be subject to the supervision of the inspection department, and with power on the part of said department to compel the placing of those wires in a proper and safe manner.

All theatres and all public halls for scenic display shall be subject to inspection at least once a year.

In case of any installation, already in operation, either of generating plant, motors, wires, or other electric apparatus located in any building or premises, becoming defective to such an extent as to threaten immediate danger to life or property, the inspection department, having notice thereof, shall have immediate power to suspend the operation of such pending the necessary repairs.

The said inspector shall, at proper hours, have the right to enter any building or premises where electric power or light is being used, to inspect all electrical wires or apparatus, in order to ascertain if the proper regulations have been complied with, and no person shall refuse to allow such inspection.

No alterations or change shall be made in the plan of wiring any building without notifying the building inspector and securing a permit therefor, and subjecting the plan of wiring to inspection as herein provided.

NOTES.

The Electric Repair and Contracting Company have taken up new premises at 617 and 619 Lagauchetiere street, where they are doing a larger business, now having two stores.

The contract for the electric plant for Messrs. Henry Morgan & Co.'s building has been awarded, the generators going to the United Electric Co., Toronto, and the switchboard to the Canadian General Electric Company.

The Canadian Bryant Electric Company were slightly damaged by smoke and water recently by the fire in Messrs. Agnews' (dry goods) premises, over which their Montreal factory is located. They have decided to close down their Canadian branch.

For hustling around looking after his men, commend Mr. J. Bennett, foreman for the Montreal Electric Company's outside department. Covering mile after mile on his bicycle, and rushing things, is his usual occupation. There surely cannot be complaint of slow attention there.

Mr. John Forman, of Montreal, has recently been on an extended visit to New York and other American cities, ostensibly to witness the international yacht race. It is rumored, however, that he has not been becalmed, and that he brought home some new agencies. Mr. Forman intends moving at once into the more commodious premises which he has lately leased and which are located about a block west of his present stand on Craig street.

The Canadian General Electric Company are to be congratulated in their chief at Montreal. Mr. Dean is universally esteemed by the trade in general. The thorough knowledge he has of his subject, and the quiet, gentlemanly way he has of impressing that fact on his customer, might serve as a "pointer" for others in electrical lines. Mr. Dean's first lieutenant, Mr. J. W. Pilcher, who has lately been promoted to the Halifax agency, has been replaced by Mr. Bell, who bids fair to become popular.

Strange when giants fight, how the small one makes a quiet, comfortable living right in amongst the fighters. Mr. Chas. Morton, manager of the Standard Electric Co. (formerly the Temple Electric Co.), of Montreal, with station located on Chenneville street, has reason to be proud of his management. As possibly the profit division may not be public, your correspondent will reserve the actual figures, merely stating that it is more satisfactory than certain others in Montreal. This may partly be due to Mr. Morton's desire to avoid legal proceedings with a customer whenever possible, and to try and give satisfaction all round. That he manages to do so is evidenced by his keeping old customers with him. The current furnished from this station is principally 250 volt direct current for motors, the lighting current now being obtained from the Lachine Company and is, of course, alternating.

CORRESPONDENCE.

SEARCH LIGHTS ON VESSELS.

MONTREAL, October 27th, 1899.

Editor CANADIAN ELECTRICAL NEWS:

SOME time ago the idea was broached by some person in Montreal to use search lights on vessels, by means of which it was intended that pilots could pick out the river buoys and guide steamships, etc., down the channel by night as well as by day. Referring to a back number of the CANADIAN ELECTRICAL NEWS, where the item appeared, I notice that storage batteries were also suggested for such vessels as did not possess their own dynamos.

The writer purposely refrained from referring to this matter before, thinking that possibly he might damage the promotion of some scheme, but seeing that the close of navigation is now upon us, and that no one has adopted the brilliant (?) idea, a few words on local conditions may not be amiss to show just what an undertaking this seemingly simple scheme means.

First, let us take vessels equipped with dynamos: The writer knows that some have alternating machines on board, which, although in itself no obstacle, would prevent any search-light which the harbor commissioners might keep on hand (or even the steamship line) as common property being utilized, as, of course, most of the equipments are direct current. The question would then be, shall two different types at least of search lights be kept on hand? Again, no matter what current was used, has any vessel got from 20 to 40 amperes to spare, which would be required for a search light to be at all useful? From a considerable experience the writer emphatically says "NO."

Without going further along this line, let us proceed to the storage battery suggestion. This the writer regards as worse than the first proposition, for at least 200 ampere hours capacity would be required, at say 45 volts, using no less than 43 heavy cells!! Now, the decks are pretty well hampered until Quebec is reached without adding this additional litter (even were it possible). To "charge" these cells we have available (unless a special plant were installed on shore for the purpose) an alternating service or direct current arc circuit, the latter being only in use from dusk until day-break, and furnishing 10 amperes!

Enough has been said to show the futility of the scheme, although why ship owners do not provide their original installation on each vessel with a permanent search light is hard to say, seeing that such a piece of apparatus would be a valuable adjunct in many ways.

Yours truly,

"HARBOR."

N.B.—What is the matter with Pintsch gas buoys?

REMINISCENCES OF THE OLD MONTREAL ELECTRIC CLUB.

MONTERAL, Oct. 19, 1899.

Editor ELECTRICAL NEWS:

Looking over some old fyles of the NEWS, it struck the writer, who was connected with the club, and who like many others that were in it still takes the NEWS, that a few words on the subject might be interesting, not only to those whose idea is to form a similar club, as is mooted for the forthcoming winter, but possibly to some of the old members themselves.

First, let it be known that the club met every cent of its financial obligations to the last, and both finances and club terminated with its last meeting. That this was so was due to the untiring work of the then secretary-treasurer, Mr. Doutre, as latterly there was a most discouraging turn-out to the meetings in point of numbers. The question will be asked as to why such a flourishing club originally slowly died out? The reason was simply "lack of new blood," i. e., of effective new blood, of members willing to take their share in submitting papers or in pertinent discussion of those which were submitted.

One of the first to leave "per force" was the first vice-president that the club had, Mr. H. Woodman, who left to assume the position of electrician for the town of Joliette, Que., and who later bettered himself as electrician for the North Shore Company's transmission plant at Three Rivers, Que. As he took an exceedingly active interest in the club's affairs, his loss was keenly felt. The next member (another of those interested members) to leave was Mr. L. Burran, who left the Royal Company at Montreal to assume the duties of electrician to the Montmorency Electric Power Company's plant at Quebec. Then followed Mr. H. Brown, who went to St. John, N. B., to manage the electric light plant at that city. Mr. L. Pignolet, who now conducts his own business in electrical specialities on Cortlandt st., New York, and many others, could be mentioned.

A few of the old boys are still quartered in Montreal, such as: Mr. J. Douglas, now superintendent of the wiring department of the Royal Electric Company; Mr. W. Shaw (former president of the club), together with his brother, Mr. J. Shaw, who now constitute the Montreal Electric Company; Mr. J. Burnett, first secretary of the club; Mr. T. Murphy, of F. Thomson & Co., now well known for his inventive genius; Mr. G. Hill and Mr. C. Doutre, both with John Forman, Montreal, and others.

The hardest work naturally fell on the secretary, which like all offices, was a purely honorary position, and it is doubtful whether Mr. Burnett the first, or Mr. C. Doutre the last holding the office, bore off the palm in that sense; certainly both were a credit to their club.

By the foregoing remarks it is clearly shown that the club was not an electric light monopoly, as there was as much interest displayed in Mr. W. Graham's (of G. N. W. Tel. Co.) paper on telegraphy as on Mr. Ritchie's (of Can. Gen. Elec. Co.) paper on alternate current machinery. Mr. Ritchie, by the way, replaced Mr. Pignolet as vice-president, only in turn to leave for Toronto himself soon after.

The club may or may not have helped some; certainly, however, it does not appear to have done any harm, as every name mentioned is holding a higher position than when members of the old club.

The papers in the main were excellent, and the only thing necessary to keep a new club going is a little more active interest. It will go, is in fact bound to go, if every member will make it a point to discuss something in papers submitted, and do their share either collectively or individually in preparing papers so that this will not be the lot of a special few. With best wishes for a resurrection,

I am yours respectfully,

"CLUB."

ELECTRIC LIGHT VS. ACETYLENE GAS.

TORONTO, October 25th, 1899.

Editor ELECTRICAL NEWS:

DEAR SIR,—I notice that the Canadian Manufacturer takes exception to the statistics compiled by the Canadian Electrical Association (not by the CANADIAN ELECTRICAL NEWS) re acetylene; and why? Has acetylene an association composed of men of integrity all over Canada who have compiled a contrary report? I think not.

Do the construction firms who are busy installing wiring for incandescent light find the demand for acetylene such as is interfering with their business? Ask them!!

Are the insurance regulations governing the installation (properly) of acetylene plants more stringent than those governing the installation (properly) of electric plants? Read them, and even a lay-man will say that they appear so.

Acetylene has its place; but that it will drive out the incandescent light from dwellings, stores, theatres, or churches yet remains to be seen. There are several companies manufacturing acetylene generators and similar fittings (I do not refer to those manufacturing carbide); have any of these paid any dividend?

Yours truly,

ONE WHO HAS STUDIED BOTH.

QUESTIONS AND ANSWERS.

A Montreal subscriber writes: Would it be possible to light a dwelling and barns in a country like Manitoba by using electric light, the motive power being a wind mill? Has it ever been tried? Would require about 25 lights. What would be the cost of a dynamo and shafting for such a plant, and for a storage battery if one was required?

Answer: It would be possible but not profitable to operate a plant in the manner suggested. If the plant was large enough and an expert electrician was put in charge of it, it might be done, but even then the cost of the light would be altogether out of proportion to its value. Unless a man is willing to put a few thousand dollars into a hobby and devote leisure to looking after it, we would not advise him to have anything to do with an experiment of this kind.

THE LATE T. G. HAZLITT.

On October 12th there passed away a prominent business man and respected citizen of the town of Peterborough, Ont., in the person of Mr. T. G. Hazlitt, president of the Peterborough Light & Power Company Mr. Hazlitt was born in the county of Armagh, Ireland, in the year 1823, and came to Canada when twenty-four years of age. He was for some years a teacher in the Picton Grammar School, and in the year 1852 removed to Peterborough and embarked in mercantile pursuits. In 1865 he became associated in the lumber business with the late Samuel Dickson, and upon the demise of the latter gentleman in 1870, the management of the estate was placed in Mr. Hazlitt's hands. In this connection he exhibited much ability, steadily building up a profitable business. In 1885 The Dickson Company of Peterborough, Limited,

The Late T. G. Hazlitt.

was organized for the purpose of carrying on the business of the estate, and Mr. Hazlitt was appointed managing director and president.

Mr. Hazlitt was the pioneer of electric lighting in the town of Peterborough. Upon the formation of the Peterborough Light & Power Company, nine years ago, he became its president, a position which he has occupied ever since.

BURLEIGH FALLS-PETERBORO-LINDSAY TRANSMISSION.

Mr. J. Alex. Culverwell, of Toronto, one of the owners of Burleigh Falls, and promoter of the Burleigh Falls-Peterborough-Lindsay electric power enterprise, states that he has succeeded in making financial arrangements with a prominent New York banking house for the completion of this undertaking. The company will be designated as the Central Ontario Power Company.

The Canadian directors have been announced in the local press as: —Hon. Richard Harcourt, Minister of Education for Ontario; James Hendry, M.P., Peterborough, president Auburn Power Co.; F. W. Barrett, Toronto, manufacturer; R. J. McLaughlin, Lindsay, barrister and director Victoria Loan & Savings Co.; Dr. Edward Adams, Toronto, and J. Alex. Culverwell, promoter, Toronto, late local manager for Toronto and Central Ontario of Royal Victoria Life Insurance Co., and formerly with Edison General Electric Co.

Burleigh Falls is situated seventeen miles from Peterborough and 39 miles from Lindsay on the same circuit. Plans of dam and power house, to be located in Perry's Gorge, have just been completed, which are said to prove that the hydraulic development will cost less than any proportionate power development on the continent. The head of water is twenty-seven feet, and the minimum flow of water in the dryest season by official reports show three thousand horse power, while the magnificent reservoir capacity adjacent to the falls (and which can be used) will give 4,500 horse power during the hours of heavy load.

The original syndicate organized early last summer purchased all the private interests at the falls, and Mr. Culverwell conducted and completed the negotiations with both governments for the acquirement of the balance of the interests.

Contracted revenue for lighting and power in the several towns was secured during the past summer to the amount of $50,000 per year of five and ten years' duration, including the street lighting of the town of Lindsay for ten years, and all the necessary franchises for the different municipalities have been secured. This revenue will be increased materially at once. It is understood that work will be commenced this fall—the hydraulic development being not a great undertaking, the main dam being built and maintained by the governments as part of the Trent Canal system, while a natural flume (Perry's Gorge) already exists, which together probably makes a saving of an expenditure of some $100,000, which would otherwise be necessary. Three 700 horse power generators and other requisite apparatus will be installed at the beginning, and allowance made in the power house for further increase.

PERSONAL.

Mr. David A. Williamson has been appointed Fellow in Electrical Engineering at the School of Practical Science, Toronto.

The resignation is announced of Mr. Geo. F. Evans, manager for Canada of the Westinghouse Manufacturing Co., Limited.

Mr. Birchard, who has been employed at the electric light works at Amherstburg, Ont., has accepted a position in the shops of the Toronto Railway Company.

Mr. W. W. Brown, who has had charge of the lighting plant at Petrolia, Ont., since its establishment, has gone to Camp McKinney, B.C., to take charge of the plant of the Minnehaha Mining Company.

Mr. John P. Northey, president of the Northey Manufacturing Company, Toronto, was married on October 24th to Miss Adelaide Wadsworth. The ceremony took place in St. Thomas church, Toronto. We extend congratulations.

The Electrical News extends its congratulations to Mr. Edward Slade, the well known electrical engineer and contractor, of Quebec, upon his appointment to the position of general manager of the Jacques Cartier Electric Light & Power Co. Besides being a thorough electrician, Mr. Slade possesses sufficient energy and progressiveness to make a success of that which he undertakes, and under his management we predict prosperity for the company. It is expected that the company will shortly be in a position to supply light and power. The poles on the streets are now being erected, and plans are in course of preparation for a handsome building to be built on the corner of St. John and d'Auteuil streets to be used as the head office. In the meantime, temporary quarters have been secured.

Incandescent lamp makers will be interested in the statement that a Frenchman, L. C. Dumas, has discovered that an alloy of nickel and steel has practically the same coefficient of expansion as glass, and may be used as a substitute for platinum in the leading-in wires of lamps. The proportion of the metals is said to be: Nickel, 45 per cent.; steel, 55 per cent. The exact composition of the steel is not stated. If this statement proves to be true, it will be of considerable importance to manufacturers of lamps.

TELEGRAPH and TELEPHONE

WIRELESS TELEPHONY.

The Carnarvon and Denbigh Herald states that for some weeks past experiments of great interest in wireless telephony, as distinguished from Signor Marconi's wireless telegraphy, have been carried on near Carnarvon by Sir Henry William Preece. Four high poles have been erected near Llanfaglan church at the south end of Menai Straits. On a sandbank across Gwyrfal river, half a mile off, four similar poles are erected. Half a mile still further, at Belan Fort, is a high pole supporting a coil of wire, one end being anchored in the deep water. Between these points Sir William has succeeded, without any intermediary other than the ether, in transmitting the sound of a succession of taps. These taps were made with a view of sending messages by the Morse code. They were distinctly heard at the receiving station by placing the newly-invented ethereal telephone to the ear, messages being sent without interruption for several days. Further experiments from Belan Fort to Llanddwyn lighthouse and to Carnarvon castle are contemplated. So far the system yields much more rapid results than Marconi's, although the sounds are not quite distinct.

CONSOLIDATION OF TELEGRAPH COMPANIES.

In answering the question of a correspondent, the Monetary Times gives the following concise particulars of the consolidation of the telegraph companies :

"In 1881 the Great Northwestern Telegraph Company of Canada leased the wires and other property of the Montreal Telegraph Company, extending over all the Eastern provinces of Canada, and over part of Manitoba and several of the northern States. It also leased the wires of the Dominion Telegraph Company in Canada. These two sets of lines were merged into one for purposes of economy. The terms of lease were that eight per cent. upon the $2,000,000 capital of the Montreal Company, and six per cent. upon that of the Dominion Company, should be paid annually. For this bargain the Western Union Telegraph Company of the United States became guarantor. For several years the G.N.W. Company was able to pay this enormous rental, even with the low rate of tolls (25 cents for ten words). But when the C.P.R. Telegraph came into existence, and the Bell Telephone Co. built lines connecting towns, the business was so divided that the G.N.W. Telegraph Co.'s revenue fell off. It has not paid dividends to its shareholders for years. But the payments to the lessors have gone on regularly every year, and the shareholders of the Montreal Telegraph Company and of the Dominion Telegraph Company get their dividends regularly of eight per eent. and six per cent respectively. The extent of wires handled by the G.N.W. Company is 40,000 miles, and by the C.P.R. about 25,000 miles."

Wm. Kennedy & Sons, Limited, of Owen Sound, Ont., have purchased a 500 light electric plant from the Canadian General Electric Company, consisting of one of the latter company's latest type H multipolar generator, with marble panel switchboard and wiring material for their work throughout.

SHORT CIRCUITS.

The North American Telegraph Company is installing a new telephone exchange for the town of Tweed, Ont.

The Yarmouth Telephone Company is building a line between Belleville and Springhaven, N.S., a distance of eight miles.

The C.P.R. is constructing a telegraph line from Harriston to Listowel, Ont. Mr. C. Hacking will be manager at the latter place.

The directors of the British Columbia Telephones, Limited, have issued their first annual report to June 30th. The statement shows a profit of £4,111.

The Bell Telephone Company has decided to construct a long distance line between Winnipeg, Portage la Prairie and Neepawa, Man. The line will be a copper metallic one.

For the supply of 165 tons of wire for the proposed telegraph line from Quesnelle, B.C., to Atlin, the contract has been awarded by the Dominion government to Mr. J. A. Seybold, of Ottawa.

Mr. W. F. Snyder, of Sydney, C.B., for some years telegraph and cable manager for the Western Union Telegraph Company in Cape Breton, and one of the best known telegraphers in the maritime province, died on October 9th, after a long illness. He was a native of Philadelphia and was fifty-seven years of age.

The telephone systems of Victoria, Vancouver and New Westminster are reported to have been acquired by a syndicate of eastern capitalits, who, besides improving the system, will establish a long distance telephone service between Victoria and the mainland. Mr. A. C. Flumerfelt, of Victoria, represented the purchasers.

Mr. J. R. MacMurty, representing the owners of the Dodge system of telephony, has made application to several municipal councils in Canada for permission to erect poles on the streets and for other privileges necessary to a telephone system. Many of the municipalities have given an exclusive franchise to the Bell Telephone Company, and are not in a position to consider the proposition.

The Merchants Telephone Company, of Montreal, held its annual meeting a fortnight ago, Mr. A. S. Hamelin presiding. It was reported that the business of the company was increasing, and that it was the intention to connect their system with as many outside lines as possible. The election of officers resulted as follows: President, A. S. Hamelin; vice-president, J. E. Beaudoin; secretary, J. M. Marcotte; treasurer, L. E. Beauchamp.

The announcement was made during the past month that Mr. Chas. R. Hosmer, manager of the Canadian Pacific telegraph system since its inauguration, is about to retire from that position. For some time past he has been gradually relieving himself of the details of the telegraph business, and before the close of the present year expects to be entirely relieved of his official duties. Mr. Hosmer's management of the telegraph branch of the C.P.R. has been such as to stamp him a man of great resource and enterprise. Rising from the "key," he knew well the details of his department, and this intimate knowledge was responsible in no small degree for his remarkable success. He has just been appointed to the directorate of the C.P.R.

The Dominion government Telegraph Department annennces the completion of the telegraph line from Skagway, Alaska, to Dawson City. The line is over 600 miles in length, and with the exception of forty-one miles from Skagway to Lake Bennett, constructed by the White Pass Railway Company, was built entirely by the Dominion Government. The schedule of rates to be charged as given below shows that a ten word message to Dawson City costs $4.35:

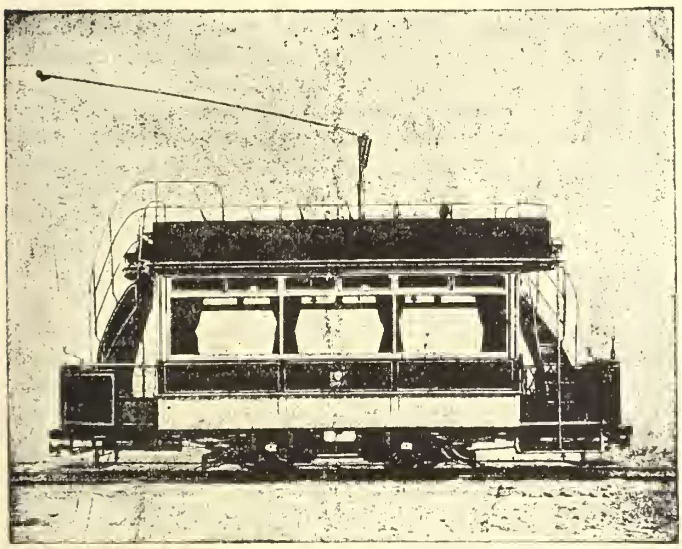
	Ten Words.	Each Additional Word.
Skagway, Alaska	$0 35	
Bennett, N.W.T.	1 35	5 cents.
Cariboo Crossing, N.W.T.	1 85	10 cents.
Tagish, N.W.T.	1 95	10 cents.
Miles Canyon, N.W.T.	2 10	10 cents.
White Horse, N.W.T.	2 10	10 cents.
Lower Labarge, N.W.T.	2 35	15 cents.
Hootelinqua, N.W.T.	2 60	15 cents.
Five Finger, N.W.T.	3 35	20 cents.
Fort Selkirk, N.W.T.	3 85	20 cents.
Dawson City, N.W.T.	4 35	20 cents.

A resolution has been passed by the town council of Pembroke, Ont., authorizing the Fire and Light Committee to negotiate with the Pembroke Electric Light Company for the purchase of its plant.

ELECTRIC RAILWAY DEPARTMENT.

ENGLISH TRAMCARS.

FROM the Electrical Engineer, of London, England, we learn that the Liverpool corporation have accepted the tender of Messrs. Dick, Kerr & Co., Limited, for 200 complete electric tramcars. This brings up the whole number of motors and cars ordered by the Liverpool corporation from this firm to 304 cars, with 620 motors. The whole of the cars and motor equipment will be manufactured in England. All the work will be done at Preston, the car bodies being made at the workshops of the Electric Railway and Tramway Carriage Works, Limited, while the motors and controllers will be manufactured by the Electrical Equipment Syndicate. The workshops of this syndicate are to be completed by December 31. These new works at Preston are designed and equipped to turn out 3,000 tramway motors and dynamos up to 50,000 h.p. in the aggregate in the course of a year. Although these figures may



AN ENGLISH TRAMCAR.

seem large, if looked at by the side of the above-mentioned order, the wisdom of fixing the possible output high is readily seen. Thus five such orders as the company has now in hand for Liverpool would take the output of the works for one year. As regards the delivery of these cars, the guarantee is that 50 cars should be supplied quarterly. The illustration we give herewith showing the general design of these Liverpool tramcars will be interesting to Canadians.

THE MONTREAL STREET RAILWAY COMPANY.

THE annual meeting of the Montreal Street Railway Company was held on Thursday, November 2nd. The annual report submitted by the directors showed a net profit of $630,870.61 for the year, as compared with $601,704.18 for the previous year. Out of this amount there were declared four dividends of two and one-half per cent. each, amounting in all to $478,333.33, leaving a surplus of $152,537.28, of which amount the sum of $50,000 was added to the contingency account, and there was charged against that fund an amount of $8,575 expended during the year for fenders and other special renewals. The percentage of operating expenses showed an increase of 3.08 per cent. as compared with last year. New car shops and other buildings were erected at Hochelaga. The rolling stock was increased during the year by 64 closed motor cars, 100 open motor cars, one pay car, and 12 electric sweepers, and there are under construction 36 closed motor cars of increased seating capacity. The Sleeman type of fender was adopted. The result of the cast welded rail joints introduced last year was satisfactory.

There were carried during the year 40,186,493 passengers, against 35,353,036 in 1898, 32,047,317 in 1897, 29,896,471 in 1896, and 25,877,758 in 1895. There were granted 12,060,867 transfers last year and 10,508,603 in 1898. The gross receipts last year were $1,660,775.93, against $1,471,939.65 in 1898. The operating expenses for the two years were $912,949.66 and $764,883.35 respectively. The annual report was accompanied by a statistical statement showing the enormous growth of street railway traffic in Montreal during the past seven years.

THE BELT LINE TROLLEY SYSTEM AT NIAGARA.

THE new bridge across the Niagara river between Lewiston, N.Y., and Queenston, Ont., completes the belt line trolley system which extends about eight miles up and down the river above and below the Falls and encloses all the Gorge. The bridge carries a single track electric car line with a roadway on each side. The main span consists of a 25 foot half-deck roadway platform carried by a pair of riveted Warren stiffening trusses suspended from four main cables 1,040 feet long between centres of towers. The end of the trusses are pivoted to rocker bents which are continued about them in the same vertical tranverse planes to their intersections with the main cable, to which they are pin connected. From the ends of their stiffening trusses the roadway is carried to solid ground by skew pans 34½ feet long on the New York side and 19½ feet long on the Canadian side. The New York span consists of plate girders and the Canadian span of I beams. The cables are designed to support two trolley cars weighing 86,000 pounds on a wheel base of 60 feet plus a uniform load of 1000 pounds per lineal foot over the whole span. The trusses are made of medium open-hearth steel and are proportioned for the same load, except that one-third of the span is assumed free from the uniform loading. The floor system is designed to carry the same trolley car load on eight axles, plus a concentrated load of 8,000 pounds at any point on each side of the roadway.

√ There is some talk of an electric railway being built between Bracebridge and Muskoka Lake.

A movement is on foot looking to the construction of an electric railway from Bear River to Digby, N.S.

The St. Hyacinthe Electric Railway Company is seeking incorporation from the Quebec government, to build an electric railway fiom St. Hyacinthe, Que., to adjacent points.

√ Messrs. Ickes & Armstrong have accepted the franchise for a street railway offered by the town of Woodstock, Ont., and it is understood that they will shortly commence the work of construction.

ENGINEERING and MECHANICS

CANADIAN ASSOCIATION OF STATIONARY ENGINEERS.

ANNUAL DINNER OF TORONTO NO. 1.

Following the custom of past years, the annual re-union and banquet of Toronto No. 1 was held on Thanksgiving Eve, October 18th. It was the thirteenth annual dinner of the association, and took place at Webh's parlors. The event was a complete success from every standpoint. The attendance was large, probably 150 persons, the accommodation of the best, and the arrangements for entertainment most complete and carefully carried out. Mr. H. E. Terry, president of Toronto No. 1, wielded the gavel, discharging his duties in such a manner as to earn the distinction of a most efficient presiding officer. Around the head table sat Mayor Shaw; Ald. Hallam; Ald. Frame; R. C. Pettigrew, Hamilton, executive president; G. C. Mooring, executive vice-president; A. M. Wickens, executive secretary; Chas. Moseley, executive treasurer; E. J. Philip, past-president; A. McRae, chief engineer Toronto waterworks; and A. E. Edkins, of the Boiler Inspection & Insurance Company. Among the other visitors were noticed A. E. Lewis and F. N. Vanzant, of the Atlantic

MR. H. E. TERRY, President Toronto No. 1.

Refining Company, Toronto; J. J. Bain, traveller Atlantic Refining Company; G. B. Towers, Vacuum Oil Company, Toronto; Wm. Sutton, Wm. Sutton Compound Company; Mr. Sinclair, Eureka Mineral Wool Company.

An excellent menu was served in Webb's usual good style and heartily partaken of. The chairman, in a few well chosen words, welcomed the engineers and their friends to the thirteenth annual banquet. He spoke of the success of Toronto No. 1, and pointed out that it augured well for the association that at the present time only two members were out of employment. The past year had been most successful, and he looked for greater things in the future. He then called upon Mr. John Alexander for a song, which was rendered most acceptably.

Proceeding to the toast list, "The Queen" was honored by the singing of the National Anthem, followed by "Canada, Our Home," with which the president coupled the name of Ald Hallam. In responding, Ald. Hallam spoke of the great extent of Canada, pointing out that it was 275,000 square miles larger than the United States and only 300,000 square miles less than the whole area of Europe. Touching on municipal affairs, he announced his intention of being a candidate for the mayoralty of Toronto, a city which he had served for twenty-eight years. A duet was then rendered by Messrs. G. W. Grant and John Alexander, who gave as an encore "Boys of the Old Brigade."

With the toast of "Toronto, Our City," were coupled the names of Mayor Shaw and Ald. Frame. Mayor Shaw was sure the engineers were sharing in the general prosperity which prevades the whole Dominion and especially the city of Toronto. The city council this year, he thought, could claim a fair measure of success, inasmuch as the encouragement given to manufacturers had resulted in the building of new factories and large additions to existing establishments. The engineers would certainly benefit by these new industries. Referring to the delay in completing the city hall, he said that it had not been an unmitigated evil, as it had given employment to workmen during the times of depression. The building was certainly a creditable one, and he thought that large buildings inspired great and noble thoughts. Upon resuming his seat he was heartily applauded. Ald. Frame complimented the chairman upon his position and for his ability as a presiding officer. The engineers, he said, were an intelligent class of men, and were entrusted with the safety of many lives. Mr. Wilt Prestwich then favored the guests with a humorous song, which called forth a hearty encore.

Mr. George Baker and Mr. John Main responded to the toast of "The Manufacturers." Mr. Baker said that the next few years gave every indication of being a period of prosperity. He had noticed that high prices for iron and good times came hand in hand. Pig iron which six months ago could be purchased for $12 per ton was now selling at $24, and there was almost a famine in steel. He was pleased to learn that the engineers were banded together for educational purposes. Here Mr. Powers sang, after which Mr. Main, the friend of engineers, was called upon. Mr. Main said that he had been present at ten of the thirteen banquets held by Toronto No. 1. Speaking from the standpoint of a boiler manufacturer, he reported business exceptionally good, and did not know of one boiler maker who was out of employment. Work from Halifax to Vancouver was coming into Toronto, but notwithstanding this he found competition as keen as ever, but thought that in the near future prices would advance. He noticed many engineers present who were at the dinner thirteen years ago in the old Montreal house on King street. To-day the engineers had better opportunities for improvement than they had at that time. Mr. Main obtained his technical education in the old Mechanics Institute at the corner of King and Church street. In his opinion, technical education fitted a person for engineering and mechanical work as nothing else can do. He advised the older men to seek to obtain this education, otherwise they would be replaced by the younger men. Mr. Main said that the enrollment of the Technical School this year was 800 and the average attendance 300, but at the present time the school was in an unsettled state owing to the necessity of new quarters. He expressed surprise that the city representatives had said nothing about a permanent building for the school. Ald. Hallam asked for the privilege to say a few words in reply to Mr. Main. The position regarding the Technical School, he said, was that the council had voted $75,000 which had been legalized by parliament, and another $25,000 was yet required. The council had appointed a committee to make a report on the question, but as yet this report had not been forthcoming. As soon as this $25,000 was voted the building would be erected. He was a firm believer in the technical school. He knew a young man who had obtained his rudimentary education in the Technical School in this city who was now in New York receiving a salary of $4,000 per year as electrical engineer.

The chairman then read a telegram from Chicago from Mr. C. H. Rust, city engineer of Toronto, regretting his inability to be present and wishing the engineers success. A trombone solo by Mr. Grey was much appreciated, after which came the toast of "The Executive," to which Messrs. Pettigrew, Mooring and Moseley were the respondents. Upon rising to speak, Mr. Pettigrew, the president of the executive, was loudly cheered. He characterized the Canadian Association of Stationary Engineers as the greatest institution in existence. The executive was prospering and was reaching out both east and west. From an educational point of view they hoped to put still more energy into the association. The secretary was sending out question papers to the different associations with a view to helping the engineers in rural places who had not as good facilities for education as are enjoyed by the members of the larger places. Mr. Alexander was called upon for another song. Mr. Mooring, vice-president, spoke particularly of compulsory legislation. This year a committee had been appointed to endeavor to obtain a law from the Ontario legislature, and he hoped every engineer would do what he could to assist the movement. The steamboa

men now had such a aw, and it was quite as necessary that stationary engineers should give proof of their ability to take charge of steam plants. The treasurer, Mr. Moseley, was pleased to state that the finances of the executive were in good condition. He also spoke of legislation, stating that the Ontario permissive law, granted in 1891, had not had the desired effect in establishing the engineering business. A compulsory law would result in placing steam plants in charge of competent men. Another humorous song by Mr. Prestwich followed.

Next came the toast "Sister Associations." Mr. Robert Mackie, in responding, made some humorous comparisons between the cities of Hamilton and Toronto, and expreseed his regret that the mayor had not remained until he (Mr. Mackie) could give him a few pointers. He said that the Hamilton association had commenced their winter educational work, holding two meetings each month, one being private and the other open to the public. Mr. Alex. McRae, a member of the Marine Engineers' Association, also replied, giving it as his opinion that a stationary engineers' law was as much required as was one for marine engineers. He instanced the case of a boiler that was taken out of a tug, condemned, and laid away as useless. This boiler found its way to a second hand dealer, who sold it to a saw mill man for his mill.

A song by Mr. Grant was encored.

A toast not found on the list was then proposed by Mr. Pettigrew and heartily drunk, it being that of "Toronto No. 1." With it were coupled the names of Messrs. H. E. Terry, A. M. Wickens and James Huggett. Mr. Terry said that as the banner association Toronto No. 1 was endeavoring to do its part. He appreciated the honor which had been conferred upon him by his election as president, and was pleased that there was such a large gathering of engineers and friends at their dinner. Mr. Wickens, in replying, said that he had been connected with the Stationary Engineers' Association since its inception. In no line of business did there exist greater necessity of advancing than in steam engineering, excepting, perhaps, in the electrical business. But the best mechanical engineers were gaining experience every day from the stationary engineers, therefore a man should take every opportunity to improve himself. In Toronto there were about 600 engineers, 220 of whom were members of the association. Any organization with education for its platform was, he thought, bound to succeed. Speaking of legislation, he contended that boiler explosions were not accidents, but were the result of carelessness, ignorance or parsimony. If the engineers were granted a compulsory law, it would be better for employers, as it would save them fuel. Mr. Huggett referred to the representation on the Technical School Board. In his opinion the stationary engineers, who were really the founders of the school, should still be represented. The association was in no way identified with the Trades and Labor Council, as some supposed.

The concluding toast was that of "The Press," responded to by Mr. E. B. Biggar, of the Canadian Engineer, and T. S. Young, of the ELECTRICAL NEWS AND ENGINEERING JOURNAL. The singing of "God Save the Queen" concluded the programme of the evening.

The untiring efforts of the members of the Dinner Committee was responsible in no small degree for the success of the dinner. This committee consisted of A. M. Wickens, chairman; Geo. Thompson, secretary-treasurer; G. C. Mooring, James Huggett, Alex. Storer, A. E. Edkins, Chas. Moseley and James Bannan. The pianist on the occasion was Mr. Harrison.

MATHEMATICS FOR ENGINEERS.*

By T. R. FESSENDEN.

[No. 1.]

If you divide any one thing into a number of equal parts and take one or more of these parts, you have what is called a fraction. Thus, if we divide a line into seven equal parts and take three of them, we have the fraction three-sevenths, written thus, $\frac{3}{7}$, the number below the line showing into how many equal parts the line is divided, and called the denominator, and the number above the line telling how many equal parts are taken, and called the numerator.

A proper fraction is one whose numerator is less than its denominator, as $\frac{9}{10}$, $\frac{12}{20}$. An improper fraction is a whole number and a fraction, called a mixed number, reduced to the form of a fraction; thus $8\frac{1}{2}$, a mixed number, equals the improper fraction $\frac{17}{2}$.

If we multiply or divide both terms of a fraction by the same number the value of the fraction is not changed; thus, 2 and 3 are the terms of $\frac{2}{3}$; now, if we multiply both by 5 we have 10 and 15, or $\frac{10}{15}$, which is equal to $\frac{2}{3}$, for if we have a unit divided into three equal parts, and again divide each of these thirds into five equal parts, or 15 in $\frac{3}{3}$, we have 2×5 of the 15th, or $\frac{10}{15}$. Also, if we divide 10 and 15 by 5 we obtain 2 and 3, or $\frac{2}{3}$. Take the fraction $\frac{16}{24}$, if we divide 16 and 24 by 4, we obtain 4 and 6, or $\frac{4}{6}$, and, dividing both terms by 2, get $\frac{2}{3}$. Thus, if we have two or more fractions of different denominators and wish to add their values together, we can obtain by multiplication equivalent fractions having the same denomination, or a common denominator, thus, $\frac{2}{3}+\frac{4}{5}$; the denominators are 3 and 5, and a common denominator is 15;

$$15\div 3=5,\ 5\times\frac{2}{5\times 3}=\frac{10}{15},\ 3\times\frac{4}{3\times 5}=\frac{12}{15},\ \text{thus}\ \frac{2}{3}+\frac{4}{5}=\frac{10}{15}+\frac{12}{15}=\frac{22}{15}.$$
$$15\div 5=3,$$

Again, $\frac{3}{4}+\frac{1}{7}+\frac{3}{8}$. The denominators are 4, 7 and 8, and a common denominator would be $4\times 7\times 8=224$, but for ease in working we use the smallest common denominator, or 56, which is the least common multiple of the denominator. Now $56\div 4=14$, $56\div 7=8$, $56\div 8=7$;

$$\frac{14\times 3}{14\times 4}=\frac{42}{56},\ \frac{8\times 1}{8\times 7}=\frac{8}{56},\ \frac{7\times 3}{7\times 8}=\frac{21}{56},\ \text{or}\ \frac{3}{4}+\frac{1}{7}+\frac{3}{8}=\frac{42}{56}+\frac{8}{56}+\frac{21}{56}=\frac{71}{56}.$$

The common way is thus:

$$\frac{3}{4}+\frac{1}{7}+\frac{3}{8},\quad \frac{42+8+21}{56}=\frac{71}{56}.$$

Draw a line below the fraction and place the common denominator below it. Under each fraction place its equivalent value in the common denominator, add the numerators thus obtained to form the new numerator, and place the common denominator as the new denominator. If we have mixed numbers, add the fractions, and if answer is an improper fraction, reduce to a whole and mixed number and then add the whole numbers.

In subtraction of fractions we must again reduce to fraction having a common denominator and then subtract. If we have to subtract mixed numbers, the figures are placed in this way when the fraction to be taken away is less than the fraction of the number to be subtracted from, as $1\frac{3}{4}-\frac{1}{3}$; the common denominator is 12. $1\frac{3}{4}=1\frac{9}{12}$: $\frac{1}{3}=\frac{4}{12}$; thus $\frac{4}{12}$ from $1\frac{9}{12}=1\frac{5}{12}$. When the subtracting is greater, as $7\frac{1}{3}-\frac{3}{4}$, after reducing the fractions to twelfths, one unit is borrowed from the greater number 7, when the subtraction is proceeded with as above.

To multiply a fraction by a whole number, multiply the numerator by the whole number, and place the result as a new numerator over the denominator. When both numbers are fractions, we multiply the numerators together for the new numerator, and the denominators for the new denominator, $\frac{2}{3}\times\frac{1}{5}=\frac{2\times 1}{3\times 5}=\frac{2}{15}$. When one or both numbers are mixed numbers, reduce to improper fractions and proceed as above.

To divide a fraction by a whole number, divide the numerator or multiply the denominator of the faction by the whole number. To divide a whole number by a fraction, we invert the fraction, i.e., change numerator for denominator, and multiply. To divide a fraction by a fraction, invert the divisor and multiply the dividend by the inverted fraction, thus $\frac{3}{4}\div\frac{5}{7}=\frac{3}{4}\times\frac{7}{5}=\frac{21}{20}$. When we have mixed numbers, we reduce to improper fractions and proceed as above.

A compound fraction is one whose numerator or denominator is a fraction, as $\frac{\frac{3}{4}}{\frac{5}{8}}$. In adding, subtracting, multiplying or dividing, reduce compound fraction to simple, and then proceed as above, thus:

$$\frac{\frac{3}{4}}{\frac{5}{8}}+\frac{1}{2}=\frac{\frac{3}{4}}{\frac{5}{8}}=\frac{3}{4}\times\frac{8}{5}=\frac{24}{20}.\quad \frac{24}{20}+\frac{1}{2}=\frac{24+10}{20}=\frac{34}{20}=1\frac{7}{10}.$$

Decimal fractions are fractions whose denominator is 10, or some power of 10, as 100, 1000, etc., and this denominator is not written but expressed by the means of a point placed to the left of the numerator, and called the "decimal point," or "point," thus $\frac{25}{100}$ is written .25. When the number of figures in the numerator is less than the number of ciphers in the denominator, we place enough ciphers to the left of the numerator to make up the number in the denominator, thus $\frac{5}{100}$ is expressed in decimals as .05. When the fraction is a mixed number as $3\frac{1}{10}$, write the whole number 3, then the point and the fraction, thus 3.1. $478\frac{962}{10000}=478.0962$. In the second case, we have three figures in the numerator and four in the denominator, and put one cipher between decimal point and the first figure in the numerator. In expressing decimals as common fractions, place figures to the right of decimal point as numerator, and for denominator 1 followed by as many ciphers as there are figures to the right of the point, thus $.45=\frac{45}{100}$. To express a common fraction as a decimal, divide the numerator by the denominator, affixing ciphers to the numerator until there is no remainder, or it appears that there will be no remainder, pointing off as many figures in the decimal as there were ciphers added to the numerator; thus $\frac{1}{5}$, by adding one cipher to the numerator and dividing by $5=.2$. In the case of $\frac{1}{50}$ two ciphers have to be added to the numerator, making the result .02. In case of such fractions as $\frac{1}{7}$, where the answer does not end, we would place the point at .1428, using only as many figures as are necessary for exactness.

To add or subtract decimals, write them under each other, with the decimal points in one line, then add or subtract as with whole numbers, and place the decimal point in the answer under its position in the column. To multiply decimals, multiply as with whole numbers, and point off in the answer as many decimal points as there are in both factors taken together. To divide decimals, divide as with whole numbers, and point off as many places as the dividend has more than the divisor.

A decimal which does not end, such as .3333 — — —, which is decimal of $\frac{1}{3}$, is a repeating or recurring decimal, and it is sufficient to carry to four places, thus .3333. It is sometimes written with a dot above the numerator repeating, as $.\dot{3}$, showing that it repeats.

* Paper read before Hamilton No. 2, C.A.S.E.

SPARKS.

Ingram & Donaldson are installing an electric light plant at Wroxeter, Ont.

An electric light plant has recently been installed in the hosiery mill at Kingston, Ont.

Cronkhite Bros. have installed an electric light plant in their woollen mill at Thessalon, Ont.

An electric light plant for the town of Thessalon, Ont., is said to be under consideration.

The ratepayers of St. Thomas, Ont., have voted in favor of an electric fire alarm system, to cost $4,000.

D. Roche & Co. purpose installing 75 additional incandescent lights in their establishment at Newmarket, Ont.

The Coaticook Electric Light Company have commenced the erection of a new power house in which they will install their arc machine.

The ratepayers of the town of Almonte, Ont., have defeated the by-law to raise $30,000 with which to establish a municipal electric light plant.

Patrick O'Toole, assistant electrician of the city of Halifax, N.S., was killed on October 14th by touching a live wire while doing some repair work.

The West Kootenay Light and Power Company have ordered another 30 h.p. three phase induction motor from the Canadian General Electric Company.

The Canadian General Electric Company are installing an electric lighting plant of 150 lights capacity for the Georgian Bay Cement Co., of Owen Sound, Ont.

The Strathroy Electric Company has refused an offer made by the council of 23 cents per lamp per night for 15 arc lamps of 2,000 candle power, on a three years' contract.

The Canadian General Electric Company are furnishing the Montreal Street Railway Company with 20 of their standard General Electric 100 railway motors.

It is said that the American visitors at Murray Bay, Que., purpose organizing a company to establish an electric plant for lighting Murray Bay, Pointe a Pic and Cap a l'Aigle.

The corporation of Bothwell, Ont., have made considerable extensions to their electric plant recently, the work having been carried out by the Canadian General Electric Company.

Robert Anderson, of Ottawa, who has been given a contract to light the streets of Arnprior, Ont., has completed arrangements to install the necessary plant in the saw mill of Geo. Malloch.

C. M. B. Lawrence, proprietor of the Oakville Electric Light Company, has purchased from the Canadian General Electric Company one of their standard single phase alternators of 1,000 lights capacity.

The General Engineering Company of Ontario has been given permission to increase its capital stock from $40,000 to $750,000. The St. Thomas Gas Company will increase its capital from $60,000 to $100,000.

A member of the Board of Trade of St. John, N. B., has given notice of motion to appoint a committee to consider the expediency of municipal ownership of gas lighting, electric lighting, and street railway transportation in that city.

The Montreal Cotton Company, of Valleyfield, Que., are continually increasing their factory power plant, and have just placed another order with the Canadian General Electric Company for six 50 h.p. and one 100 h.p. induction motors.

The village council of Weston, Ont., has accepted the tender of the Canadian General Electric Company, Toronto, for electrical apparatus, and that of the Goldie & McCulloch Co., Galt, for engine and boiler for electric light plant. The total cost is $6,690.

The Hospice St. Joseph de la Delivrance, of Levis, Que., is about to build an aqueduct, for which plans have been prepared by David Ouellet, architect, of Quebec. There will be 5,500 feet of cast iron piping, with brass valves, etc. A hot air engine will be used to raise the water in the building.

The Royal Electric Company, of Montreal, are installing in the head office of the Merchants Bank of Canada, of that city, two 50 k. w. direct connected generators, with Robb-Armstrong engine, complete with switchboards. These generators are to operate at 250 volts, and the building is wired for lighting to operate lamps at 220 volts and also two Sprague elevators. We believe this is the first complete electrical installation in Canada fitted out with 220 volt lamps.

At a recent meeting of the city council of Hull, Que., a motion was submitted to enter into negotiations with the Hull Electric Co. or the Ottawa Electric Co. to light the streets of the city. It was decided to leave the matter in abeyance until the legal dispute now pending between the two companies is settled.

According to the New Westminster Columbian, a company has been organized at New Westminster, B. C., for the purpose of manufacturing electric light carbons. We are told that they have secured water power rights on Stave river and will transmit electric power to the proposed works in New Westminster.

The town of Paris, Ont., is to have a second electric light plant, Mr. W. H. Meldrum, with a number of local people, having formed a new company. They have purchased a complete outfit, consisting of Leonard Ball engine and boilers, and from the Royal Electric Company a complete S.K.C. two-phase plant, the dynamo having a capacity of 50 k.w. The work of installing the new plant is now under way.

Regarding the market for mica in Australia, Mr. J. S. Larke, of Sydney, in a report to the Dominion Government, says: "Some ground or rather finely broken mica is used here for making a covering for steam pipes. It at present comes from India, where £8 per ton is paid for it. As there may be considerable refuse mica in Canada from which this article is made, I send a sample of the article with this report."

The Soulanges canal connecting lakes St. Francis and St. Louis, in the province of Quebec, has been completed, and was officially opened last month. The length of the canal is 14 miles. Nine miles from the lower end is situated the power house, where 500 horse power is developed, under a head of 20 feet, and used for generating electricity for lighting the canal and for operating the bridges, sluice gates, etc. The electrical apparatus in the power house was furnished by the Canadian General Electric Co., of Toronto, and the water wheels by the Stillwell-Bierce & Smith-Vaile Company, of Dayton, Ohio.

The Canadian General Electric Company have just received an order from the Trenton Electric Company for a 75 light equipment of their alternating series enclosed arc lamps, with automatic regulating transformer and switchboards. These are to be used for lighting the streets of the city of Belleville, Ont., the current being taken from the three phase transmission lines coming from Trenton, a distance of 13 miles, where the power is generated. This is the third installation of this kind which is being put in in Canada, 100 lights capacity having been installed in Sherbrooke, Que., and 100 lights in Halifax, N.S., both of which are giving eminent satisfaction.

The Trent River Paper Company, of Frankford, have placed an order with the Royal Electric Company for one of their 40 k.w. S.K.C. two-phase generators, with full complement of transformers and supplies. It is the intention of this company to not only light their own large premises, but also the following villages, viz.: Frankford (one mile distant), Stirling (nine miles distant), and possibly Foxboro and Wooler (six miles distant). Work of excavation for the new mill of this company was commenced on the 27th of May last, and the fact that within the next two weeks this company will be making paper is an evidence of the capabilities of the genial manager, Mr. Walter S. Miller.

Canadians will be interested in learning that Prof. Carus-Wilson, late professor of electrical engineering at McGill University, Montreal, and who is now in England, is preparing plans for an undertaking having for its object the utilization of the tunnel which some years ago was constructed in the heart of London. This tunnel was built in 1859 by the Pneumatic Despatch Co. for the purpose of carrying mails and parcels from the general post-office to the North-western Railway station by means of an underground chute, but the difficulties of utilizing pneumatic pressure on such a large scale proved insuperable. The idea was that a train of cars heremetically fitting the tube should be pumped from the post-office to Euston. Sufficient allowance, however, was not made for air leakage and other disadvantages, and after increasing the horse power from 300 to 800 horse power, the scheme failed, and $850,000 lay wasted underground. Recently an enterprising engineer conceived the possibility of accomplishing by means of electrical traction that which could not be done with compressed air, and with this end in view the services of Prof. Carus-Wilson have been retanied. He is said to be preparing plans for fitting the tube, which is two miles long, with an electric train and lighting it with incandescent lamps. The proposed train will draw four cars, each carrrying nine tons, at the rate of from 25 to 30 miles an hour.

SPARKS.

Geo. Thompson, of Belleville, has installed an electric light plant in the drill shed in that city.

The city of Belleville, Ont., will likely install an electric fire alarm system, for which tenders will shortly be invited.

The name of the Montreal Island Belt Line Railway Company has been changed to the Montreal Terminal Railway Company.

Messrs. T. J. Duncan and W. A. McDonald, of Rossland, B. C., have applied for incorporation of the Rossland & Sophie Mountain Electric Railway Company.

The first electric tramway in China has been opened for traffic. It extends from the Pekin railway station at Machiapu to the south gate of the capital, a distance of four miles.

The Ashcroft Water, Electric Light & Improvement Co., of Ashcroft, B.C., purposes installing additional electrical apparatus with a view to furnishing light and power for mining purposes.

The Dominion Cartridge Co., Lachute, Que., are increasing their electric lighting plant, and have placed their order for a 20 k.w. generator and switchboard with the Royal Electric Company, Montreal.

The Richmond Electric Company, of Richmond, Que., have installed a second 75 k.w. S.K.C. generator to meet the increasing demand for electric lights. They have also installed a number of motors, from 5 to 15 h.p., which operate from the S.K.C. system.

The Pacific Coast Power Co., Limited, has been granted a provincial charter, to construct a dam across Powell river in New Westminster district, and to convey water to some point on the sea-coast to be used for the development of power. The capital of the company is $50,000.

The Grand Forks Water, Power & Light Co., of Grand Forks, B.C., has submitted the details of its undertaking to the government. It is proposed to build a dam across the north fork of Kettle river about one mile from Grand Forks, and to construct a flume to carry the water to the point of development. Work must be in commenced within twelve months.

Prof. Rutherford Macdonald, Professor of Physics at McGill University, Montreal, recently gave the first of a series of lectures on "Electric Waves and Oscillations." Prof. Rutherford has made considerable research work in this subject, and some years ago devised an apparatus with which he could transmit messages a distance of half a mile without any connecting wire.

Since Saturday, the 21st of October, the town of Dundalk has been basking in the rays of the electric light, their new plant being started on that day. The plant is owned and operated by the municipal council, and consists of Leonard engine and boilers and an S.K.C. 30 k.w. dynamo. The streets are lighted with incandescent lamps and make a very attractive appearance.

Mr. R. G. McLean, of Toronto, has given a contract to the Waterous Engine Company, of Brantford, for a 50 horse-power McEwen engine for his printing establishment, to be installed immediately. This will replace the 30 h.p. Wheelock engine now in use, Mr. McLean's business having so increased as to demand additional power. His steam plant is under the superintendence of Mr. H. E. Terry.

The Montreal Street Railway Company have appealed against the assessment of their poles, wires and rails under the new tax imposed in the city charter. The assessment placed upon these is $280,000. The company have 96 miles of single track, making the valuation $3,000 per mile. The company claim that the valuation for a similar tax in the city of Toronto is only $1,050 per mile, and they ask that their assessment be reduced accordingly.

The steamer Sardinian, which is transporting the Canadian contingent to South Africa, is well supplied with artificial illumination for "The Soldiers of the Queen." The Royal Electric Company, of Montreal, started to install a complete electric lighting equipment on this steamer on Saturday, October 21st, and turned over the plant, consisting of one 20 k.w. direct current generator, with 325 lights installed, complete in operating condition, on Thursday, October 26th.

The Niagara Central Railway Company have commenced the conversion of the road between St. Catharines and Niagara Falls into an electric line, and it is expected that cars will be running by January 1st. The cars are being built by the Ottawa Car Company, and will be 50 feet long, with baggage and smoking compartments and accommodation for forty-eight passengers. They will be heated by steam, supplied with Nightingale air brakes, and will rest on double trucks.

TRADE NOTES.

The Geological Survey Department of the Dominion Government have ordered a large iron show case from the Goldie & McCulloch Co., Limited, Galt, Ont., for the Paris Exposition.

Messrs. Richardson & Sons, Bedford, N.S., have purchased a complete electric lighting plant for their factory from the Royal Electric Company. The Maritime Electric Co., of Halifax, are making the installation.

The Goldie & McCulloch Co., Limited, Galt, Ont., have recently received some very nice orders for wood-working machinery from the Maritime provinces. They are also busy on orders for similar machines for different parts of Ontario.

The Goldie & McCulloch Co., Limited, Galt, Ont., have just completed and shipped to Mexico, via Vera Cruz, 15 large bagasse filters for sugar plantations there. They also have a large order for special machinery for the St. Charles Condensing Co., a United States firm who are opening a Canadian branch manufactory at Ingersoll.

The Palmerston Carriage Company, Limited, of Palmerston, Ont., have decided that the old-fashioned kerosene lamps are not good enough for them, and have placed their order with the Royal Electric Company for a complete electric lighting equipment, consisting of a 100-light dynamo, switchboard, and all necessary wiring throughout the factory.

Readers of the ELECTRICAL NEWS are reminded that Mr. C. E. Shedrick, of Sherbrooke, Que., is still manufacturing the Whitney electrical instruments for Canada, as well as the Wright discount meters. Mr. Shedrick reports that he has orders on hand far in excess of the capacity of his factory, but next spring he hopes to overcome this drawback by enlarging his buildings and plant.

The Ogilvie Milling Company have contracted with Sadler & Haworth, manufacturers of leather belting, of Montreal and Toronto, to supply them with a mammoth leather belt for their new mills at Winnipeg, Manitoba. It will be 72 inches wide, three ply thick, and over one hundred and thirty feet long. This belt, when finished, will be the widest and heaviest leather belt in use, or ever made in Canada.—Toronto Globe.

Messrs. Ahearn & Soper, of Ottawa, have closed contracts within the last few weeks for nearly 5,000 h.p. in Westinghouse induction motors for use in the city of Montreal. The motors will be operated from the circuits of both the Royal Electric Co. and the Lachine Rapids Hydraulic & Land Co. The contracts include a 100 h.p. motor for operating the new factory of the Dominion Oil Cloth Co., a 20 h.p. motor in Peter Lyall's stone works, three motors of 5 to 15 h.p. in the new factory of the Wire & Cable Co., and about twenty motors running from 50 to 300 h.p. each for the mills of the Dominion Cotton Co. The motors in each case are of the Westinghouse Tesla induction type.

MOONLIGHT SCHEDULE FOR NOVEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H.M.	H.M.	H.M.
1....	P.M. 5.30	A.M. 5.30	12.00
2....	" 5.30	" 5.30	12.00
3....	" 5.30	" 5.30	12.00
4....	" 5.30	" 5.30	12.00
5....	" 5.30	" 5.30	12.00
6....	" 6.30	" 5.40	11.10
7....	" 7.30	" 5.40	10.10
8....	" 8.40	" 5.40	9.00
9....	" 9.50	" 5.40	7.50
10....	" 11.00	" 5.40	6.40
11....	" 11.00	" 5.40	6.40
12....	....	" 5.40	5.30
13....	A.M. 12.10	....	
14....	" 1.20	" 5.50	4.30
15....	" 2.30	" 5.50	3.20
16....	No Light.	No Light.	.....
17....	No Light.	No Light.	.....
18....	No Light.	No Light.	.....
19....	No Light.	No Light.	.....
20....	P.M. 5.10	P.M. 8.30	3.20
21....	" 5.10	" 9.30	4.20
22....	" 5.10	" 10.30	5.20
23....	" 5.00	" 11.30	6.30
24....	" 5.00	A.M. 12.30	7.30
25....	" 5.00	" 1.00	8.00
26....	" 5.00	" 1.30	8.30
27....	" 5.00	" 2.30	9.30
28....	" 5.00	" 3.30	10.30
29....	" 5.00	" 4.30	11.30
30....	" 5.00	" 5.30	12.30
		Total.........	212.20

THE EFFICIENCY OF 220-VOLT LAMPS.

The Elektro Technische Rundschau quotes the results of some experiments recently carried out in Karlsruhe to ascertain the life and efficiency of 220-volt incandescent lamps. No less than six different makes of lamp (all German, it is presumed) were subjected to the test, the first measurements with the photometer taking place after the same had been burning 15 hours, when the energy consumed was also determined. Subsequent to these measurements the lamps were subjected to an endurance test on a 220-volt circuit. After 344,792 and 1,150 working hours respectively, measurements were again taken to determine the energy consumed and the candle power of the lamps. The graphic representations of the values so discovered show that the lamps, when new, consumed from 3.8 to 4.3 watts per candle, while the actual candle power of 16 c.p. (nominal) lamps amounted to between 11.4 c.p. and 14.9 c.p., that of 10 c.p. (nominal) lamps being only 8 c.p. After 600 working hours the 16 c.p. lamps were found to consume four to five watts per candle power, the intensity of the light given varying between 11.7 c.p. and 14.2 c.p. Thus, says the Electrical Engineer, the test proved anything but favorable relative to the bulk of the samples. The energy consumed is considerable compared with lamps of lower voltage, and the candle power decreases rapidly with the hour's run. This is especially the case with 10 c.p. lamps, which must, indeed, be termed unserviceable. Individual lamps supplied by the same firms differed considerably, both as regards candle power and efficiency, which must be ascribed to careless grading. A variation in the voltage amounting to 1 per cent. effected a change in the candle power of 6 to 7 per cent., which agrees with observations repeatedly made in regard to 110-volt lamps. In conclusion, it is remarked that the introduction of high voltage lamps will be of little advantage so long as their efficiency remains so much behind that of ordinary lamps.

Here is part of the Montreal Transvaal Company, now en route to South Africa: H. H. Walker, age 25, 54th Battalion, Richmond, electrician, birthplace Stockport, Eng.; D. Middleton, age 27, Prince of Wales' Fusiliers, electrician; Michael Kelly, age 22, Prince of Wales' Fusiliers, electrician, birthplace Ottawa.

PUBLICATIONS.

Catalogues received during October include a very complete one from the Brown & Sharpe Manufacturing Company, manufacturers of machinery and tools, Providence, R.I.

Messrs. Wilber B. Driver & Co., of 126 Liberty street, New York, have issued a useful booklet entitled "Resistance Wires," which contains many useful tables of the resistance, temperature, coefficient, spacific gravity, etc., of their well known makes of wire. These include the "Climax," "Adamance," "D" and "Hercules" binding wire.

Two hundred and twenty pages represent the number contained in the October issue of the Street Railway Review of Chicago. This is a souvenier number, issued just previous to the annual meeting of the American Street Railway Association held in Chicago from October 17th to 20th. The issue reflects great credit upon the publishers. The letter-press pages are replete with half-tone illustrations pertaining to Chicago and to the various railway enterprises in the vicinity, which include every type of motive power, horse cars, cable cars, trolleys, third rail, three-phase, storage battery and compressed air systems. During the progress of the convention the publishers of the Street Railway Review issued a daily edition containing full information concerning the programme of the day and an account of the previous day's session.

SPARKS.

It is reported that Mickle, Dyment & Son are considering the lighting of the streets of Severn Bridge, Ont., by electricity.

The streets of Palmerston, Ont., have recently been in darkness, due to friction between the town council and the electric light company.

John Penman, of Paris, Ont., is installing a model electric plant for the lighting of his residence, purchased from the Canadian General Electric Company.

The corporation of Neepawa, Manitoba, has contracted with the Canadian General Electric Company for one of their standard 75 k.w. monocyclic alternators, with switchboards, transformers and wiring supplies.

The tender of the National Carbon Co., of Cleveland, Ohio, for the supply of ⅜ × 14 inch coppered carbons, has been accepted by the city council of Winnipeg. The price is $13.50 per thousand f.o.b. Cleveland.

The Canadian General Electric Co. are installing two of their standard 45 k.w. multipolar generators for Messrs. Tooke Bros., of Montreal, Que., together with switchboards and three 15 h.p. direct current motors.

Mr. J. E. S. Trelawney, of the Anglo-Canadian Syndicate, has applied to the Quebec government for a lease of a water power at Bryson, Que., with the object of developing the power for electrical and other purposes.

The Canadian General Electric Company have received an order from the Acadia Edison Co., of Wolfville, N.S., for two of their standard 25 kilowatt, multipolar, direct current generators, with switchboards, etc., complete.

A new electric company has been formed in Dutton, Ont., for the purpose of supplying light, heat and power to the corporation, merchants and residents of the town. The Canadian General Electric Company are supplying all the electrical apparatus, transformers and wiring. Their initial order is for a 30 k.w. single phase alternator.

It is said that the Deschenes Electric Co., the Hull Electric Co., and R. & W. Conroy, mill owners, will claim damages from the Metropolitan Electric Co., on the ground that the works now under construction by the latter company at Britannia will divert the waters of the Ottawa river from the natural channel and damage the properties of the above parties. The power houses and mills of these companies are located on the side of the river opposite the Metropolitan Company's works.

D. G. Whidden, of Antigonish, N. S., has placed an order with the Canadian General Electric Company for a 500 light direct current plant.

The Canadian General Electric Company have received an order from the Summerside Electric Company, of Summerside, P.E.I., for one of their standard 120 kilowatt single phase alternators.

The corporation of New Westminster have contracted with the Canadian General Electric Company for one of their standard 150 kilowatt monocyclic generators, with switchboards, etc., for the supply of light and power throughout the city of New Westminster.

Mr. D. P. Tobin, of Lancaster, last winter experimented in ice cutting with a "Model" gasoline engine. So well did the experiment work that the Goldie & McCulloch Co., Limited, Galt, has received orders for Mr. Tobin for two more engines to be used this winter for the same purpose.

The Nelson Electric Tramway Co., of Nelson, B.C., have placed an order with the Canadian General Electric Company for their entire requirements electrically, consisting of one standard 325 k.w. railway generator with panels, one 500 h.p. three-phase revolving field synchronous motor with panels, together with full complement of cars and motors. They have also contracted with the West Kootenay Power & Light Co., of Rossland, B.C., for the power necessary to operate their plant.

Among recent orders for Ideal engines placed with the Goldie & Culloch Co., Limited, Galt, Ont., are the Dominion Bridge Co., Lachine, Que.; Kennedy & Sons, Owen Sound; Intercolonial Ry. Co., St. John, N. B., and others. Among the orders for Wheelock engines are the Standard Shirt Co., Montreal; Barrie Electric Light Co.,; Vulcan Iron Co., Winnipeg; R. C. Ennis, Neepawa, Man; corporation of Prescott, Berlin Rubber Co., and others. The firm are running overtime to keep up on orders.

SPARKS.

The Orillia power scheme is being pushed by the contractors as rapidly as possible, although it is probable that the work will not be completed this year.

The council of the town of Woodstock, Ont., is wrestling with the question of municipal ownership of the electric plant. A special committee has recommended that a vote of the ratepayers on the question be taken on the first Monday in January.

The Ingersoll Electric Light Company has recently installed additional machinery, including a 125 h.p. Leonard high speed engine, 150 h.p. Goldie & McCulloch boiler, steam pumps, etc.

Mr. C. H. Mitchell, hydraulic engineer, of Niagara Falls, Ont., has made a report to the town council of Bracebridge, Ont., on a plan of increasing the power for electric lighting purposes. The increase will be about 600 horse power, the power house to be built at the foot of the falls, and the cost being estimated at $20,000.

It is expected that the new electric light plant at Neepawa, Man., will be completed and put in operation some time this month.

The electric light plant at Morden, Man., is owned by a gentleman residing in England, who has decided to close down the plant unless he succeeds in finding a purchaser.

The town council of Newcastle N. B., has invited tenders for the installation of an electric light plant, to be operated by water power. The plans for same were prepared by Mr. Duncan.

The Canadian General Electric Company have closed a contract with the Imperial Oil Company, of Sarnia, Ont., for one of their standard 40 k.w. direct current generators, direct connected to Ideal engine.

The Dartmouth Electric Light Company, of Dartmouth, N.S., have placed an order with the Canadian General Electric Co. for one of their standard 30 k.w. single phase alternators with switch-board, transformers and wiring complete.

Mr. A. M. Wickens, chief engineer for the Ontario government, has condemned the boiler at the Ontario Agricultural College, Guelph, used for threshing, chopping and grinding. It is probable that a new engine and boiler will be purchased.

The town council of St. Marys, Ont., recently invited tenders for supplying street electric lights for one year from December 31st. Only one tender was submitted, it being from the present contractors, Weir & Weir. Their tender, $43.50 per lamp per year for 31 lamps, has been accepted.

The Massey Harris Company, Limited, have decided to equip their Toronto factories with a modern system of electricity for light, heat and power. They have contracted with the Canadian General Electric Company for two 100 k.w. direct current generators, direct connected to Ideal engines. In conjunction with these they are installing generator and feeder panels, arranged for controlling the system of lighting throughout all the different departments. This plant will be one of the largest isolated installations in Canada.

Another large manufacturing business is being established at Sault Ste. Marie, Ont., which promises to reach vast proportions in the near future. Mr. F. H. Clergue, president of the Lake Superior Power Company, has been instrumental in interesting American capital in the formation of the American Alkali Company, of which he is vice-president. They purpose manufacturing caustic soda and other similar products under electrotype processes, and their initial plant will require 1000 h.p. for its operation. They have placed an order with the Canadian General Electric Co. for three 330 h.p. specially designed generators, to be direct connected to water wheels. The plant is expected to be in operation by November 1st.

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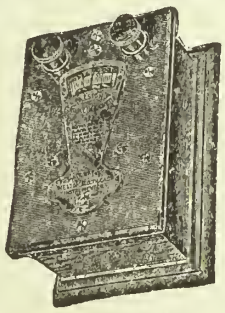

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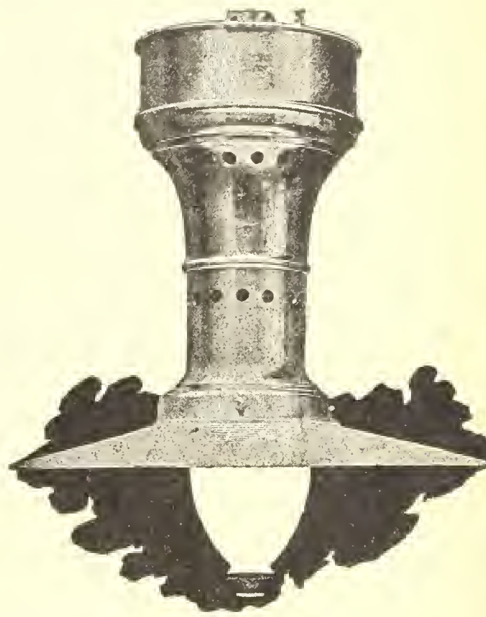

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CANADIAN

ELECTRICAL NEWS

AND

ENGINEERING JOURNAL.

VOL. IX. DECEMBER, 1899 No. 12.

AN ELECTRIC HEATING AND COOKING PLANT.

In their new hospice building at Niagara Falls, Canada, the order of the Carmelite Fathers have installed a modern electrical plant for lighting, heating and cooking purposes. This plant has taken the place of all other kinds of fuel for cooking and heating in the building, no less than 100 horse power being used for the various purposes.

The building in which this plant is installed is 200x250 feet, the distance from the ground to the top of the tower being 85 feet. The following particulars of the electrical equipment are found in the Electrical World:

The current used by the Carmelite Fathers is obtained from the Canadian Niagara Power Company. It is generated in the station of the Niagara Falls Park and River Railway, where the Canadian Niagara Power Company has installed a temporary plant pending more elaborate development under its franchise privileges, in order that the Canadian side of the river at the Falls may have all the electrical power called for in factories and other places. The power station is located about two miles from the hospice, and the current is carried over No. 3 bare copper wire strung on a pole line. The transformer house of the hospice plant is a small wooden building located about 150 feet from the main building. It contains two 30-k.w. Westinghouse and one 25 k.w. General Electric transformers, primary 2,200 volts and three-phase secondary 110 volts, current being transmitted through underground cable to the switchboard in the main building. The switchboards are located in the basement. A switchboard with double-throw switches controls two phase of the current, and the third phase is controlled by a switchboard adjoining the first one, and is used for cooking, lighting, etc. The two switchboards are so arranged that either transformer can be used independent of the other for either purpose.

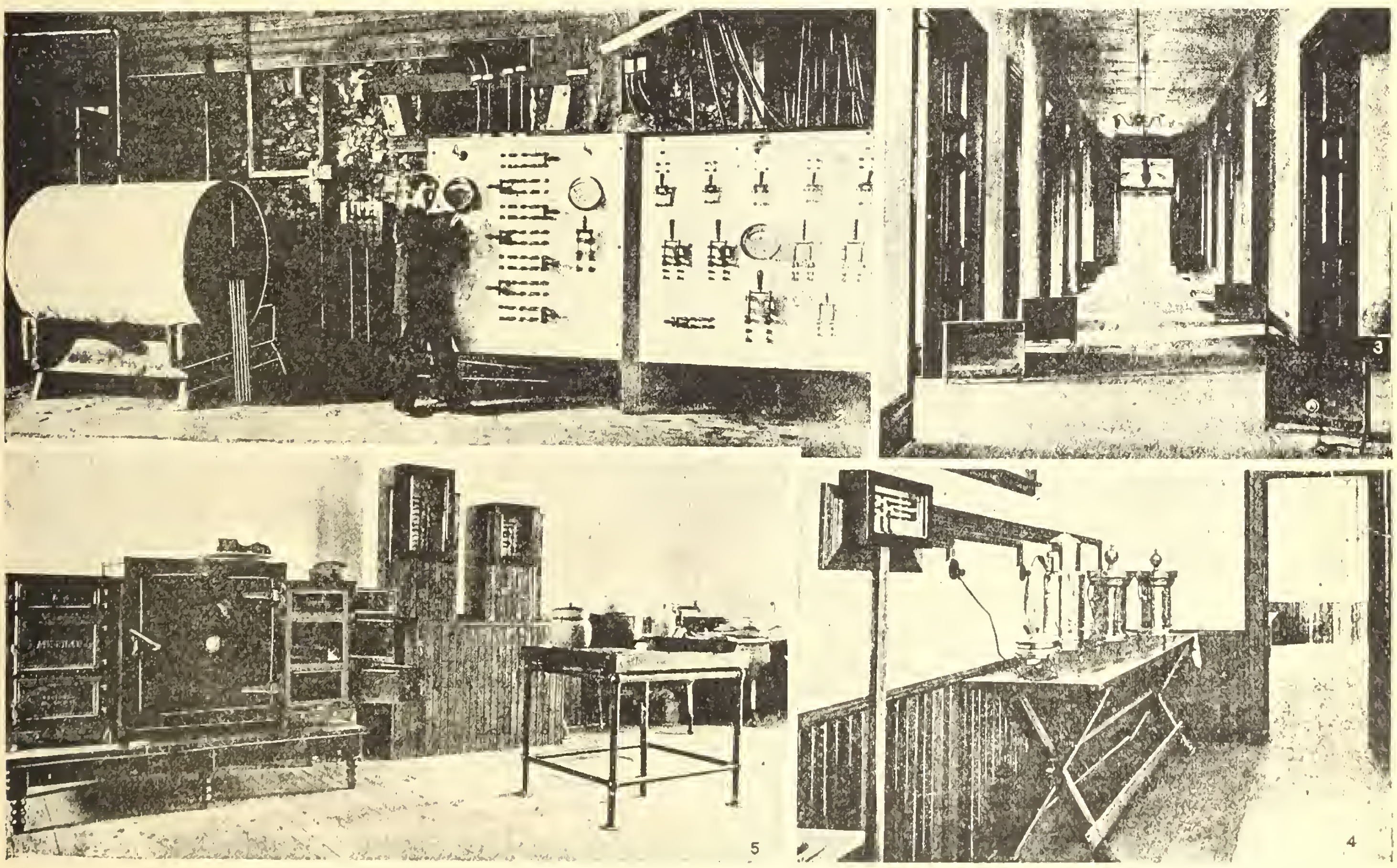

Fig. 2.—Electrically Heated Boiler. Fig. 3.—Corridors. Fig. 4.—Butler's Pantry. Fig. 5.—Electric Kitchen.

ELECTRIC HEATING AND COOKING EQUIPMENT IN CARMELITE HOSPICE, NIAGARA FALLS, ONT.

In the hospice building there are 200 16-c.p. incandescent lights, the current supply of which is taken from 25 horse power used for this purpose, for cooking and for heating water. The total amount of power taken by contract is 100-h.p., and the other 75-h.p. is applied to heating the lower floor of the hospice building, which comprises 11 bed rooms, a dining room, reception room

and office, and the corridor. This corridor is 120 feet long, 10 feet wide and 15 feet high. In it are installed nine 4-h.p. heaters. Each of the bed rooms is 10 by 12 by 15 feet and in each one there is one 4-h.p. heater with a changeable heat switch of two heats.

The kitchen of the hospice is equipped with an electric combination range and three electric ovens. This range has a heating surface of six square feet, each square foot of surface consuming 15 amperes and having a switch that allows the current to be controlled at full or half heat. Of the three electric ovens two of them are small and one large. Each of the small ovens has three compartments, and consumes 23 amperes of current at 110 volts, while the large oven takes 50 amperes. This oven equipment is so arranged that four 25 pound roasts can be handled at one time.

In the butler's pantry there are electrically operated urns and a chafing dish. The urns are three in number, each of five gallons capacity. One of the urns is used for making tea, one for making coffee, and the other for heating water for use in the tea and coffee urns.

Down in the basement, standing close by the switchboards and in the same room, there are two boilers electrically operated. One of these has a capacity of 400 gallons, while the other has a capacity of 150 gallons. The 400 gallon boiler is used for heating water for laundry and bath room purposes, and takes a current of 120 amperes, being divided in three heats. The small boiler is used for heating water for kitchen use, but can also be used in connection with the large boiler. The small boiler takes 125 amperes, being also divided into three heats. It is used principally for quick boiling. Both of these boilers are covered with 2½-inch asbestos covering. All water is boiled, so far as possible, when current is not being used for other purposes.

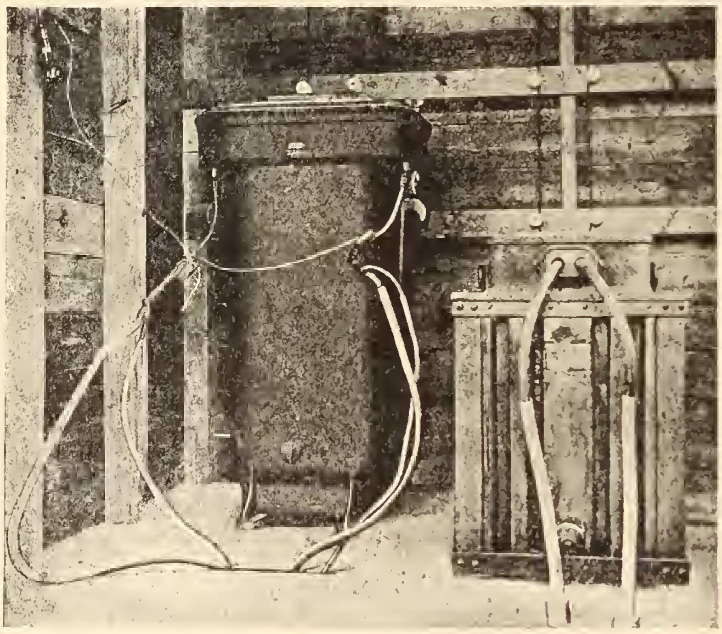

Fig. 1.—Transformer, Carmelite Hospice.

The electrical kitchen has been found capable of most successful operation, and on June 15th, on which day the building was formally blessed by His Grace, the Archbishop of Toronto, the Most Rev. Denis O'Connor, D D., of Toronto, dinner was cooked for 250 people. This did not include the soups, which, owing to their taking hours of time in their manipulation, were prepared in the kitchen the day before. But all meat and other food were cooked electrically that day. In the big boiler it is possible to heat from 60 degrees to 212 degrees in six hours with full heat. In the small ovens bread can be baked in 18 minutes. On the door of the big oven is a barometer which shows the heat and indicates the temperature through the different times of roasting and baking. The heat of the ovens is kept uniform from the start to the finish of the cooking.

The current used for water heating, cooking and lights costs $25 per h.p. or $625 a year, while the 75 h.p. used in heating the corridor and bedrooms is secured at about one-fifth this price per h.p. It is evident that the heating service is not in use only during certain months of the year, and in addition to this the power is obtained from a station where in winter time there is a surplusage, owing to the fact that not as many cars are operated in winter on the scenic line as during the summer time. But one important feature demonstrated to the owners of the plant during the past winter was that a combination fuel and electric hot water heating installation might be found more serviceable under present conditions than the separate electrical installation, for much trouble has been experienced on the Canadian side in winter in the matter of power development from anchor ice, in fact during last winter the ice was very troublesome on both sides of the river. At times the current was entirely cut off, and at such times and under such circumstances a fuel service under the boiler to heat water for general heating purposes would have been deemed ideal. The plant of the hospice was installed by Mr. A. Harth, and he has expressed a belief that such a system of heating would be most advantageous not only at Niagara but in other places where people seek to use electricity for heating purposes, whether in factory or residence. The idea thus expressed is, that instead of carrying the current through the building to heaters located here and there, it might, in many cases, be better to install a hot water heating plant and apply all the current to the boiler for heating the water for circulation through the building, and where the electric service is for any reason likely to be cut off have a fuel service at the boiler ready for immediate operation.

No doubt many other new ideas will be developed at Niagara in the matter of using electricity for heating, but the plant in the hospice has given great satisfaction, and is the wonder of all who see it. One very noticeable feature of the kitchen is the entire absence of dirt and soot on the various utensils used on the stove or in the ovens. The plant as a whole requires but little care for its operation and management.

[Since the above was written the power house of the Niagara Falls Park and River Railway, from which the current was obtained, has been destroyed by fire.—Ed. Electrical News.]

It appears as if it were only a question of a very brief time, says the Engineering Magazine, before petroleum motors designed upon the principles demonstrated by Diesel, Banki and others will come into general use, not only for small powers, but also for general service.

A motor car is about to be put in operation between Ashcroft and the gold mines of Cariboo, B.C., a distance of 200 miles. The vehicle is now being built in Vancouver, and will be completed early in the spring. It will have accommodation for twelve persons, besides 1,000 pounds of freight, and if its operation is successful other carriages will be put on the line. Steam will probably be used as the motive power.

BY THE WAY.

We have become accustomed to the phrases "The Sturdy West" and "The Effeminate East" as applied respectively to the new and older provinces of Canada. These phrases express the truth that battling with difficulties incident to the development of a newly settled country develops a sturdy and self-reliant manhood, while, on the contrary, the easy conditions prevailing in more highly civilized communities tends to weaken in men these desirable qualities. I was reminded of this fact by a recent conversation with a young man who has grown up with one of our western towns, and for quite a number of years has been identified with the electrical business. He had few advantages for the acquirement of technical knowledge, but lost no opportunity of improvement, and has fought his way up through many difficulties to an important and responsible position. When the street railway generators burned out, and the man in charge declined to undertake their repair, this young man was asked if he could do the job. Although having but a very limited knowledge of the machines, he promptly answered "yes." So dubious were the owners regarding his ability that they offered to pay him a fixed sum (not a very liberal amount) if he succeeded, but with the provision that he must furnish his own material, so that they might be put to no risk. It took two or three days and much worry to complete the work, but the young man was determined to succeed, and he did. In telling me the story he said : "Many of the young men I meet are too ready to say 'I can't' when a difficulty arises, and it is therefore not surprising that some who have been eight or ten years connected with electric stations, have made little or no advancement. They have not shown their employers that they are capable of doing the things which would earn for them promotion. The ease with which, in cities, someone can be got to make repairs, is a stumbling block in the way of young men, who under less advantageous conditions would be compelled to use their own hands and brains in overcoming difficulties. Another obstacle in the way of the young man's progress in the east, is pleasure in its many alluring forms, which makes it difficult for those not blessed with large powers of determination to pursue the more rugged and profitable path of duty."

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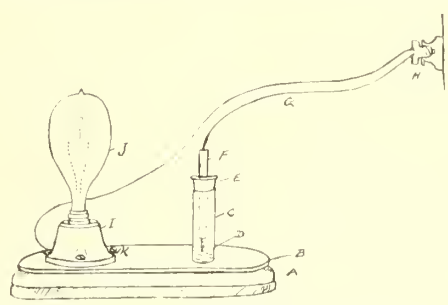
"It's surprising how Canadian business men allow themselves to be 'taken in' by Yankee sharpers," said the manager of a large industrial concern with whom I conversed recently. He went on to tell how a gentleman from across the line had brought into Canada what was claimed to be an entirely new method of lighting, designed to throw into the shade the present arc and incandescent systems. On the strength of his claims and his ability to produce a brilliant light some business men, including, strange to say, a lawyer, were induced to give up some of their hard earned dollars to assist in developing the enterprise. At this stage the idea occurred to the lawyer that it might be advisable to get the opinion of a friend of his who was qualified by experience to judge of the value of the new discovery. Accordingly a visit was made to a bicycle repair shop, where the invention was in operation. In reply to the enquiries of the lawyer's friend the inventor began a description of the modus operandi of his system, which, as a certain writer has expressively put it, was "as clear as mud," and was intended to pull the wool over the eyes of the uninitiated. The lawyer's friend did not, however, belong to this class. He took in the situation at a glance, and mentally stamped the word "humbug" in large letters on the whole outfit. What he saw was this : An iron receptacle resembling the upper part of a kitchen boiler, filled two-thirds full of a liquid which the sense of touch and smell declared to be coal oil. The space above this liquid was filled with air pumped in with a hand pump. Attached to the tank were small pipes through which the oil was forced by the pressure of the air in the tank, and discharged into the bottom of a vertical pipe of larger diameter heated to a high temperature, contact with which served to transform the oil into gas. The gas on rising to the top of the pipe became mixed with air supplied from pipes opening into the atmosphere. The gas and air thus commingled then passed downward and were fed into a group of Bunsen burners fitted with Welsbach mantles which were thereby heated to incandescence. The system embodied no new principle but simply accomplished by a very round about method what has been done for years by the direct use of gas and the Bunsen burner. The enterprising promoter, on realizing, by the questions and remarks of the lawyer's friend, that the bubble had been pricked and that he would be called on to refund the advances made to him, or in default face the courts, pleaded the receipt of a telegram urgently requiring his presence at home, as a reason for taking his hasty departure.

CIGAR AND PIPE LIGHTER.

A correspondent sends the Electrical News the accompanying drawing showing a cheap and simple form of cigar and



pipe lighter for alternating or direct current circuits—any voltage, —with the following explanation :

A—Wood base.
B—Mica or asbestos veneer.
C—Small wide mouthed phial.
D—Wood alcohol or methylated spirit.
E—Cork ; hole drilled through centre.
F—Piece of vulcanized fibre rod, drilled through.
G—No. 16 cotton incandescent cord, one end passed through fibre rod and insulation removed at exit from rod.
H—Pony wall receptacle, with fused attaching plug.
I—Pony wall receptacle, other terminal of No. 16 cord connected to one side clamp.
J—32 c.p. or 50 c.p. lamp, voltage—same as current supply ; base to suit receptacle I.

To operate, wipe end of rod F across free receptacle clamp K and spirit absorbed will be kindled instanter. If done fairly quickly the lamp J will not even light up.

The town of Yarmouth, N.S., is furnished with water pumped by electricity, the current being supplied by the Yarmouth Street Railway Co., at a cost of $200 per month. The company have notified the corporation that they cannot continue to furnish the power at this figure after February 7th, 1900, and consequently the council is considering the advisability of putting in a steam plant to furnish power for pumping, and also for operating a dynamo for street lighting. The services of an electrical engineer will be engaged to give advice on the subject.

CORRESPONDENCE.

THE FIRST 220-VOLT PLANT.

TORONTO, Nov. 9, 1899.

Editor CANADIAN ELECTRICAL NEWS:

DEAR SIR,—In your November issue we notice an item stating that the Royal Electric Co. are installing a 250-volt plant in the head office of the Merchants Bank of Canada, and that it is believed to be the first complete installation in Canada fitted out with 220-volt lamps. We beg to state that last September we installed a complete 250-volt direct connected plant for Messrs. Gowans, Kent & Co., in this city, which in addition to operating three elevator motors, is operating four hundred 250 volt incandescent lamps. We believe this to be the first complete installation in Canada using 250 volt lamps, as the Merchants' Bank plant has not yet been installed.

We enclose copy of letter from Messrs. Gowans, Kent & Co., which explains the satisfaction derived from the above plant purchased from us.

Yours truly,
UNITED ELECTRIC CO., Limited.

TORONTO, Nov. 8, 1899.

UNITED ELECTRIC CO., Ltd.:

GENTLEMEN,—We are pleased to say that the electric plant which you installed for us in September last, consisting of 30 k.w. multipolar generator direct connected to 9 x 10 Robb engine and Mumford boiler, is giving the best of satisfaction. We are glad that we followed your suggestion to adopt the 250 volts presure instead of 110 volts as contemplated, thus enabling us to operate our light and motors jointly, with greater economy, and also to connect our circuits at any time to the commercial power circuit should we not desire to operate our engine.

We heartily recommend the adoption of this system for isolated power and lighting plants, and you are welcome to bring prospective customers to examine our plant.

Yours truly,
GOWANS, KENT & CO.

THE MONTREAL ELECTRIC CLUB.

MONTREAL, Dec. 4th, 1899.

Editor ELECTRICAL NEWS:

DEYR SIR,—"Club's" letter in your November number recalls some pleasant recollections of our late Montreal Electric Club. There has not heen, nor is, to the writer's knowledge, any other electric club here which exactly fills the place that this one used to occupy. Not until the club had terminated did the members really appreciate the benefit of those evenings. The writer, for one, gained valuable instruction from the various papers, discussions, debates and lectures. We met once a fortnight.

It must be remembered that in those days electrical applications were not nearly as widespread as they are to-day; the street railway was changing over from animal power; incandescent lighting was being introduced; arc lights were fewer; telephones were scarce; house bells a wonder; interior wiring a matter of individual taste, no rules being enforced or practiced; no college course could be had here that was of any use. We were seeking or experimenting for knowledge for our daily needs, and whenever we could get some visiting or well known expert to come before us, didn't we just pump him all we could.

The social side of the club was also important. The evenings were unspoiled by useless formality—merely a simple order of proceedings was observed.

One of the most interesting features of our evenings was the debates. These, at first, tried with hesitation, ended by becoming the best attended meetings, and it seems amusing now to think of the nerve with which we talked on leading questions of the day.

"A FORMER MEMBER."

USE OF ENCLOSED ARC LAMPS.

MR. L. B. Marks contributes to the Electrical World and Engineer some statistics showing the rapidity with which enclosed arc lamps have come into use. Up to 1895 open arc lamps were used very largely, but that year marked the turning point in arc lamp practice, brought about by the introduction of the enclosed arc lamp, which bids fair to almost entirely supersede the open type. In the year 1895 the number of open arcs in use was greater than those of the enclosed type, but has since dropped rapidly each year. The records for thirty-two cities in the United States show that in 1896 there were in use 23,605 open arc lamps and 1,203 enclosed arc lamps, while in 1899 the number of open arcs in use in these cities was 16,010 and the number of enclosed arcs 20,848. These figures show a decrease of open arcs in three years of thirty-two per cent., and an increase in enclosed arcs of 1,600 per cent. It is estimated that there are now in use in the United States about 150,000 enclosed arc lamps, of which more than half have been installed within the past two years. The total number of enclosed arc lamps in Great Britain and the Continent is given as 55,000, but it should be stated in this connection that the first commercial use of enclosed arcs abroad began about a year later than in the United States.

MR. R. B. WILLIAMSON, M. E.

THE features of Mr. R. B. Williamson, M. E., now principal of the Electrical Department of the International Correspondence Schools, Scranton, Pa., but at one time a resident of Canada, are shown in the accompanying portrait. Mr. Williamson graduated in Electrical Engineering at Cornell University. After graduating he spent two years at electrical construction work, including the complete installation and operation of electric light plants. This work also included the installation of steam engines, and involved a large amount of interior wiring. During the same time he also did considerable designing in connection with dynamos and motors. In 1895

MR. R. B. WILLIAMSON, M.E.

he was chief draftsman for the Canadian General Electric Company, at the same time engaged largely in designing work in connection with dynamos and motors, both for direct and alternating currents. While with that company he gained considerable experience in the construction and operation of street-railway apparatus, together with all kinds of switchboards used in street-railway and power plants. In 1896 he accepted a position as Instructor in Electrical Engineering at Lehigh University, going from that University to the International Correspondence Schools. While at Lehigh University he had complete charge of the courses in dynamo-electric machinery and the design of electrical apparatus. He also had charge of the work in connection with the electric street railways, and did considerable special work on alternating currents.

The School of Electricity of the Colliery Engineer Company, over which he has charge, includes seven courses, as follows: Electrical Engineering, Electric Power and Lighting, Electric Lighting, Electric Railways, Electric Mining, Wiring, and Bellwork.

The Hammond Reef Consolidated Mining Company, Ltd., are installing at their mine a cable derrick which will be operated by a 20 h.p. induction motor. This, together with the generating plant and mill motors, will be in operation within a week. The Canadian General Electric Co., who have the entire contract, have sent their expert to superintend the starting.

REPORT ON TRIALS MADE AT MAGOG, QUEBEC, TO TEST THE ECONOMY EFFECTED BY COMPRESSED AIR.

By Prof. J. T. Nicolson, D. Sc. (Edinburgh and McGill), M. Inst. C.E.

These trials were made during the month of April, 1899, at the Dominion Cotton Mill, Magog, Canada, where there is installed a 150 horse power hydraulic air compressing plant on the system devised by C. H Taylor, of Montreal. They were made at the instance of Mr. John A. Inslee, of St. Louis, and conducted under the auspices of Mr. Inslee, the Taylor Hydraulic Air Compressing Co., and the Dominion Cotton Mill Co., jointly.

The trials were conducted by the undersigned, assisted by Professor R. J. Burley, B. Sc., etc., of McGill University, but a number of prominent engineers from the United States were invited to be present and took part in the experiments. Among others I may mention Mr. A. Langstaff Johnson, of Richmond, Va., Mr. William O. Webber, of Boston, Mass., and Mr. John Birkinbine, of Philadelphia, Pa.

Experiments were made on five different methods of using compressed air in an ordinary steam engine of the Corliss type.

1st. The air was supplied to the engine cold.

2nd. Steam was injected into the air in the main pipe before supplying it to the engine.

3rd. The air was injected among the water in a steam boiler and heated by mixing with the water and steam of the boiler before being supplied to the engine.

4th. The air was blown upon the surface of the water in a steam boiler and heated, by mixing with steam in the same before being made to drive the engine.

5th. The air was passed through a tubular heating vessel and heated by a coke fire, afterwards being used to work the engine.

For all the experiments the air was drawn at a pressure of 53 lbs. from the 5-in. main air pipe of the Taylor air compressor, which supplies power to the mill, and was piped to a 12-in. diameter by 30-in stroke Corliss engine, supplied for the purpose of the trials by the Laurie Engine Company, of Montreal.

A friction brake was fitted on the fly-wheel of this engine and the engine in this way was worked up to its full power at about 75 revolutions per minute.

Connection was made to a Lancashire boiler 7 feet diameter by 30 feet long when it was desired to mix steam with the air for purposes of pre-heating.

When dry heating was resorted to the air pipe was led through a heater on its way to the engine, having been previously blanked off from the steam boiler. This heater was designed by the writer and built by Messrs. The Laurie Engine Co. for these experiments ; but, as it was designed of such size as to heat the whole of the compressed air used in the mill, it was considerably larger than was required to heat the greatest quantity of air which could be used by the Corliss engine employed on the test. It was, therefore, a matter of some difficulty to prevent the heater and the small quantity of air passed through the same from becoming hotter than was desired.

For the experiments made without pre-heating the observations made were as follows :

The temperature of the air before entering the engine.

The same on leaving the engine.

The pressure of the entering air, indicator cards from each end of the cylinder, readings of the revolution counter and of the rope break weights.

A trial was conducted with cold air on April 27th, in the presence of Mr. Birkinbine, which gave the following results :

The air entered at 66.5 F. and was exhausted at —41 F., the revolutions being 74.6 and the cut-off about one-third of the stroke. The indicated horse power was 27 and the weight of air used per hour was 1,671 lbs. This gives about 841 cubic feet of free air at 60 F. per i.h.p. hour.

On another trial made under same conditions 850 cu. ft. of free air were used for per i.h.p. hour.

2. In the case of experiments made with the dry heating, the following observations were made :

The temperature of the air before entering the heater ; after passing up the first row of tubes ; upon leaving the heater ; before entering the engine.

The temperature of the furnaces and flue gases of the heater were also taken, the former with a Callendar's patent electrical promoter.

The amount of coke (Sherbrooke gas coke) used was carefully weighed and the trial only began when the conditions had become teady, i.e., about three hours from the time of beginning the run wtth heated air. Cards were taken ; the brake horse power and the revolutions were also observed.

With air entering the heater at a pressure of 53½ lbs. gauge and at a temperature of 58.2 F., it was raised to 225 F. after passing the first row of tubes, and 363 F. upon leaving the heater. Owing to undue length of air pipe and lack of proper covering, the air fell in temperature to 287 F. before entering the engine. It was exhausted at 88 F., and the pressure at the engine was 52½ lbs. by gauge.

The temperature of the gases leaving the fire was only about 700 F.—and was reduced to 100 F. in the flue of the heater. It was difficult to use a small enough quantity of coke in such a large heater without letting the fire out altogether. A closed ash pit was used and the air for combustion supplied from the compressed air main and could be regulated to a nicety.

Under these conditions and with exactly the same cut-off as in trial of cold air, the indicated horse power being 26.7 and the revolutions 70 per minute, there used 1,310 lbs. of air per hour ; this gives a consumption of 640 cubic feet of air per i.h.p. per hour, a reduction of 850—640—210 cu. ft. of free air per i.h.p. per hour due to pre-heating. Thus 210-850, a saving of 24.7 per cent. is effected in the quantity of air used.

This saving was effected by the burning of 9.3 lbs. of coke per hour, or of 9.3-26.7 348 lbs. per h.p. per hour.

These results may be stated otherwise as follows :

To produce 100 h.p. with cold air, 85,000 cu. ft. of air were required in this engine ; when pre-heated to 287 F., the horse-power yielded was 85,000—640—133 h.p., and as this heating was effected by the burning of $\frac{9.3 \times 133}{27}$ 47 lbs. of coke per hour ; the additional 33 h.p. were obtained by an expenditure of 47 lbs. of coke per hour, or at the rate of $\frac{47}{33}$ 1.42 lbs. of coke per hour additional.

If we assume that this gas coke had ¾ of the calorific value of good coal, it is seen that we obtained an additional horse-power for every (1.42 x ¾) 1 lb. of coal burnt in the heater.

As an ordinary steam engine and boiler of this size would require from 4 to 8 lbs. of good coal per h.p. per hour, it is seen what a very economical mode of using the heat this is. Heat is used 4 to 8 times as efficiently in a compressed air pre-heater as it is in a steam engine and boiler.

With regard to the results of this trial it ought to be remarked that a large radiation loss per lb. of air used was taking place, both on account of the undue size of the heater and on account of its distance from the engine. Much more favorable results can be, and in fact have been obtained, when the size of the engine and heater are properly proportioned.

Professors Riedler and Guttermuth have obtained an additional horse-power in air motors for every ¾-lb. of coal burnt to heat the air. This is an economy far surpassing that of any prime motor in existence.

In large plants with first-class air motors, where double or triple pre-heating might be resorted to, a better result than even this can easily be obtained.

In a large transmission plant consisting of a Taylor Air Compressor, a five-mile pipe line, air engines and electric generators, with coke pre-heating stoves, the full or gross power of the water fall can be obtained at the terminals of the dynamo, at a comparatively insignificant cost for fuel.

No other system of energy transmission can compare with this for economy of first cost and maintenace.

3. Tests were made of the economy to be obtained by heating the air by mixing it with steam from a boiler before allowing it to do work in the engine.

The results are of the highest scientific interest, and show the adaptability of compressed air to almost any condition of employment. As regards economy, this method is, however, inferior to that of dry heating. By mixing from 10 to 13 lbs. of steam per h.p. with the air, the quantity of air required was reduced from 850 cu. ft. to 300 to 500 cu. ft. per i.h.p. per hour. Thus the air required for 100 h.p. engine running with cold air would be sufficient to operate an engine of 85,000 400 210 h.p. if mixed with 12½ x 100—1,250 lbs. of steam per hour. This can be supplied by about 140 lbs. of coal per hour ; so that 110 h.p. additional were obtained by the burning of 140 lbs. of coal or 140—110—1.3 lbs. of coal per i.h.p. per hour additional.

Such a method of heating, economical as it may appear, would, however, be unsuitable except for powers of over 50 h.p. unless waste steam is available from a boiler plant at times of low demand.

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Correspondence is invited upon all topics legitimately coming within the scope of this journal

The "Canadian Electrical News" has been appointed the official paper of the Canadian Electrical Association.

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Peculiar Method of Appointing a Chief Engineer. The city council of Toronto recently appointed Messrs. George C. Robb and A. M. Wickens to examine and report upon applications for the position of chief engineer of the new municipal buildings. It is surprising to learn on enquiry that applications for this important position were not publicly invited. It is further learned that no particulars were placed at the disposal of the experts regarding the duties of the position, and no one about the building appears to have any idea of what these duties will be. Under these circumstances, the experts have a somewhat difficult task to perform. They will be obliged to go over the building and estimate for themselves what duties should appertain to the position of chief engineer, and in the light of the information thus gained, examine and report upon the applications which are understood to be in the hands of the city officials. The number of these applications is reported to be large, but in what way they were received is not publicly known. The council's method of selecting a man for this important position is unsatisfactory. Applications should have been advertised for, and a date fixed for their reception. The duties of the position should have been clearly specified by the city engineer or some other competent person. The method of procedure adopted, leaves room for the suspicion that probably there exists some favored applicant, to whom the position has been promised, and that the engaging of experts to report upon the applications is simply a device to give the appearance of fairness to the appointment.

A Word to Lighting Companies. WE have reason to believe that some of the owners and managers of electric lighting companies have not read with sufficient care the provisions of the Conmee Bill passed at the last session of the Ontario Legislature, defining the conditions on which municipalities may engage in the electric light business where a private company is established. One of the most important clauses in the Bill to electric lighting companies is Sub-section 26, which reads as follows: In case there is any gas or electric light company supplying gas, electric energy or light or water company supplying water in any municipality the council may, by by-law, fix a price and terms to offer for the supply by contract by such gas or electric light company of gas or electric energy or light for street lighting and other public uses, or for the supply by contract by such water company of water for street hydrants and other public uses for a term of not less than five years and not more than ten years, and after thirty days have elapsed after notice of such price and terms has been communicated to the company without the company's having accepted the same, the council may, under the provisions of this Act, as to arbitrations, name and give notice of an arbitrator to determine the price and terms of the contract for such supply of gas or electric light as aforesaid, and in case the company and the municipality do not agree, the said price and terms shall be determined by arbitration under this Act." The important point in this clause to lighting companies is, that where an offer of purchase is made to a company by a municipality, and declined by the company, the company must, regardless of any action of the municipality, appoint, within thirty days after such offer of purchase has been made, an arbitrator to act on its behalf. If the company fail to thus appoint an arbitrator within thirty days after the offer of purchase, the municipality would seem to have the right to refuse to enter into ar-

bitration, and may proceed to purchase and install a lighting plant. There are other points of the Bill which are scarcely less important, therefore lighting companies should make themselves thoroughly acquainted with every detail and understand clearly the interpretation of every provision.

The Telephone Field. THERE is evidence to justify the belief that the telephone will become much more generally used in the near future than it is to-day. In the large cities and towns it has been adopted very largely for business purposes, and even the farmer has to some extent recognized the advantages of telephonic communication. It is in this latter direction that we look for one of the most promising fields for the extension of the telephone business in the future. Particularly in the harvesting season does the farmer realize the advantages of having telephone connection with an adjacent village or town, by means of which he can order necessary repairs and supplies. The state of Ohio in the United States, is noted for its rural telephone system. Hundreds of farmers have telephones in their homes, and in addition to business advantage, their families are afforded some of the social privileges that are frequently lacking on the farm. The use of the house telephone in this country is, to our minds, restricted to a much greater extent than it should be or will be in the near future. There is also likely to be a considerable increase in the number of private exchanges. These effect a vast saving of time, and permit the heads of departments to communicate with all parts of the establishment without leaving their offices. In the United States the expiration of the Bell Telephone patents, and the competition thus permitted, has resulted in the development of the telephone business to a remarkable extent.

Electric Power Distribution and the Small Consumers. IN an interesting article under the above title, in the Engineering Magazine for November Dr. Louis Bell discusses the advantages afforded by electricity to small consumers of power. He also points out to electrical companies that the supply of current for power in small units can be made profitable where a sufficient number of such consumers can be obtained. He estimates that few consumers of steam power of 50 horse power or under can obtain their power for less than 5 cents per horse power hour actually employed, and that where an ample load can be obtained large generating stations can put electrical energy upon their circuits at a total cost somewhat under one cent per horse power hour, thus enabling them to supply the consumer at a large reduction. The possibilities of electrical distribution of current for light and power from a central water power generating station are likewise considered. As an example of a successful enterprise of this character the writer calls attention to what has been done by the Compagnie Electrique de la Loire at St. Etienne, France, where, by means of the three phase system, power is supplied in small units to 2,500 ribbon looms which formerly were operated by hand, but found themselves unable to compete with the large manufactories in the cities operated by power. A quarter horse power motor serves for each loom, so that the total load connected amounts to about 1,400 horse power. The charge for each quarter horse power motor is 10 francs per month. The company also operate 100 horse power in miscellaneous motors and 8,000 incandescent lamps, and are said to have made a success of their enterprise. Dr. Bell points out further that the utilization of electricity in the manner described would be the means of restoring prosperity to many of the towns throughout the country where manufactories were formerly located, but which are suffering from centralization of the manufacturing business in cities, where advantages in the way of cheaper power and improved transportation facilities are available. So far as the latter advantage is concerned, it is shown that the same system which supplies light and power might also be used to operate electric railways for passenger and freight purposes, which would tend to equalize transportation advantages.

Operation of Electric Street Railways. THE system of electrical distribution adopted by the Metropolitan Railway Company represents a new practice in the operation of street railways in Canada. This road is, we believe, the first in this country to employ both direct and alternating currents for the propulsion of cars, but the system will undoubtedly gradually grow in favor in connection with the operation of long distance lines. It has only recently come into use in the United States, the Chicago & Milwaukee Electric Railway being one of the first to be so operated. This road is divided into sections, each section, except the one contiguous to the power house, being operated from a sub-station containing an equipment of transformers and rotary converters. This is the method adopted by the Metropolitan Railway Company, but a further step in advance has been taken, inasmuch as both direct and alternating current is generated by the same machine. The direct current passes direct from the generator to the line, and is employed to operate that portion of the road adjacent to the power house. The alternating current, generated at low pressure, is stepped-up by means of transformers to a high voltage and transmitted to a sub-station sixteen miles distant, where it passes through transformers and converters and goes to the line at low pressure direct current for operating that portion of the road remote from the power house. It is admitted that this system of electrical generation and distribution has many advantages, as, for instance, making at once available direct current for use in the three-wire system without passing through auxiliary machines. The alternating current, however, in order to be suitable for service at a distance, must be raised in pressure by means of transformers. This system is, therefore, open to the objection—perhaps overbalanced by its advantages—that it necessitates an expensive station equipment because of the rotary converters and transformers required for changing the pressure and kind of current. There is reason to expect that this object will eventually be overcome in some way, probably by the introduction of machines capable of generating both direct and alternating current at the desired pressure, or, in other words, by high voltage alternating and low voltage direct current generators. This would obviate the necessity for auxiliary apparatus in the generating station. The certainty of the rapid extension of interurban electric railways in this country makes of paramount importance the question of the most practicable and economical system of operation.

Tooke Bros., Montreal, have bought three more 8 h.p. motors from the Canadian General Electric Co., for use in their factory.

MONTREAL

Branch Office of the CANADIAN ELECTRICAL NEWS,
New York Life Building,

MONTREAL, Dec. 2nd, 1899.

It need not surprise anybody if it is found shortly that a prominent Canadian electrical company will not only do the lighting but the wiring for the Canadian building of the Paris Exposition. It is said that if they are the successful tenderers they will send their own wiremen and material from this side of the water, also generators, and follow our usual practice. National Board rules, it is said, are to govern.

It may interest some of our readers to know that the steamship Arawa, being used by the British government as a troopship, and which is reported as being delayed owing to a break-down in her electrical machinery, belongs to the Elder Dempster Co., and lately ran to Montreal. Her electric machinery referred to is the lighting plant, which is in duplicate, and consists of alternators of the Ferranti type delivering current to the lighting circuits at a potential of 110 volts.

According to a contemporary all fires not put down to "electric lights" are put to "Israelites."

The apartment building being built on Dominion square, Montreal, for Mr. M. S. Foley, is to be lighted throughout by electricity, the tenderer for the wiring being Messrs. Mount Bros. The architects are Messrs. Saxe & Archibald, Montreal. Iron armoured conduit is specified.

In the person of Mr. R. Whyte, the Lachine Rapids Company have a rarity—not alone for the fact that everybody has a good word to say of him, and he has a good word to say for them all in the trade, but because as secretary-treasurer of the company he has also a fair practical knowledge of the electric lighting industry. Mr. Whyte was first connected with Mr. Lawson, who, we believe, first represented the Brush interests, and later was with the Edison Company. Later still he was employed by the Canadian General Electric Company and the Royal Electric Company successively, to assume finally his present duties, where he carries the best wishes of not only his old practical friends, but also of the new Lachine Rapids Company's customers.

The Montreal Wire & Cable Company expect shortly to be in operation. They are now awaiting alternating motors ordered, by which they intend to operate their various machines. It is understood that it is not the intention to direct-connect, but to use a motor on each flat or section. The building chosen is that formerly occupied by E. A. Small & Co., wholesale clothiers, at the foot of Beaver Hall Hill. There is ample floor space and each flat has sufficient windows to constitute a well lighted factory. Incandescent light will be used for artificial illumination, the current being supplied by one of the lighting companies in the city. Alex. Barrie, manufacturer of rubber covered wires, together with his plant (which will be augmented), has been absorbed by the new concern, and Mr. Barrie will attend to the practical work. The management will be in the hands of Mr. Sise, jr., who was formerly with the Western Electric Co., of New York.

The recent disclosures in the daily press of crooked dealings of officials of several departments of the city service reminds me of a conversation had recently with a gentleman representing an Ontario company who do business in the city of Montreal, and who have found it difficult to conduct business here owing to their refusal to pay commissions to certain individuals connected with the city service. I heard of an instance the other day where the inventor of a non-freezing valve stated that after having found it impossible to introduce the invention in this city, he at last succeeded in doing so by following the advice of a friend who told him that a certain amount of money placed with a certain individual would remove the obstacles out of his way. The money was placed accordingly, and the obstacles immediately disappeared. An amusing story was also told me which serves to define the standard of business probity existing in this locality. A director of the Montreal Park & Island Railway who was also interested in the toll-gate system, was asked by a gentleman, while passing through the toll-gate one day, what check was kept upon the toll-gate keeper to insure his making proper returns of the money paid to him. The director's reply was: "Oh, we do not keep any check on him; he's an honest man; he would not steal more than a dollar or two per week."

"What we have we will hold," said the person who held the electrodes of the induction coil!

Mr. John Forman has purchased the entire stock in hand of the Canadian Bryant Electric Co., who lately decided to close their Canadian factory.

Mr. C. E. Shedrick, electrical instrument manufacturer, of Sherbrooke, Que., paid a visit to his trade friends in Montreal last week, and, I understand, secured some orders.

Mr. A. F. Gault is the owner of the flat apartments being built on Milton street, and named "The Marlboro." They are to be wired for electric light thoughout. Messrs. Taylor & Gordon are the architects.

Messrs. Collyer & Brock, of this city, have secured a contract to re-arrange and add to the incandescent light equipment of the Montreal Rolling Mills Company, also to add to their D. C. series arc equipment in the yard.

The Lachine Rapids people are looking forward with interest to the approach of winter, which they claim will this year have no terrors for them. The new steam power reserve is installed for emergencies and the engines have been tested.

The Richelieu and Ontario Navigation Company contemplate building a large hotel at Murray Bay, Que., during the winter. An electrical plant will probably be installed for lighting. Tenders for the wiring have already been called by Messrs. Maxwell & Shattuck, architects.

Look out for the next legal electric fight at Quebec. The poles of the Jacques Cartier Company are going in pretty near to those of the Montmorency Electric Co., and a struggle in the courts similar to one recently held in Montreal may be expected when the lines get strung and into operation.

The Royal Electric Company have a "good thing" in their new Stanley meter, "magnetic flotation" type. It will have to be a remarkably high efficiency lamp that this meter will not only start on, but keep an accurate note of the consumption, and that lamp need not be a 16 c.p. one either, by any means.

Mr. R. A. Ross, electrical engineer for the Canadian Pacific Railway Company, is back again in Montreal. He has been for a time in China, and came back via Burmah, making a tour of the world. Mr. Ross does not speak in very glowing terms of some of the electrical construction work he witnessed abroad.

The block of four houses, with grey limestone fronts, lately built on Dorchester street west, corner of Hallowell street, in the suburb of Westmount, are the property of Mr. D. J. Darling. The architect for same was Mr. A. J. Cooke, and the electric light wiring and bells was done by the Montreal Electric Company.

Mr. C. J. McCuaig, of McCuaig, Rykert & Co., mining brokers, Montreal, is building a couple of handsome red stone houses on Sherbrooke street, adjoining the property of Mr. Jas. Linton. Messrs. McVicar & Heriot are the architects. The wiring for electric light and annunciators fell to the Montreal Electric Company.

It is currently rumored that a new lamp factory (incandescent) will shortly be operated in Montreal or vicinity. It is said that the Bryan Marsh Co. (who conduct a similar industry in the United States) will manufacture their lamps here, in company with three or four local men of capital connected with the electrical business. The output is placed at 1,000 lamps per day.

The Montreal Street Railway Company already have the sympathy of the electrical trade in their gallant fight to try and resist what seems an unjust mode of taxation; they might also have the sympathy of the general public if they would provide increased car accommodation for business men at business hours. Some say lack of cars is the trouble, but one electrically versed says it is lack of copper. It is a well known fact that Quebec, with fewer cars, etc., is wired heavier than Montreal, so it would appear as if the latter view was not far out.

About a year ago a prominent Notre Dame street furrier had an acetylene plant and fixings installed, and threw out his electric light. Some months later the Underwriters' inspector visited him and caused some expensive changes to be made. Now he has electric light re-installed, and the plant for light which ruined the eyes of his operatives and made a nasty odor in the establisment is for sale.

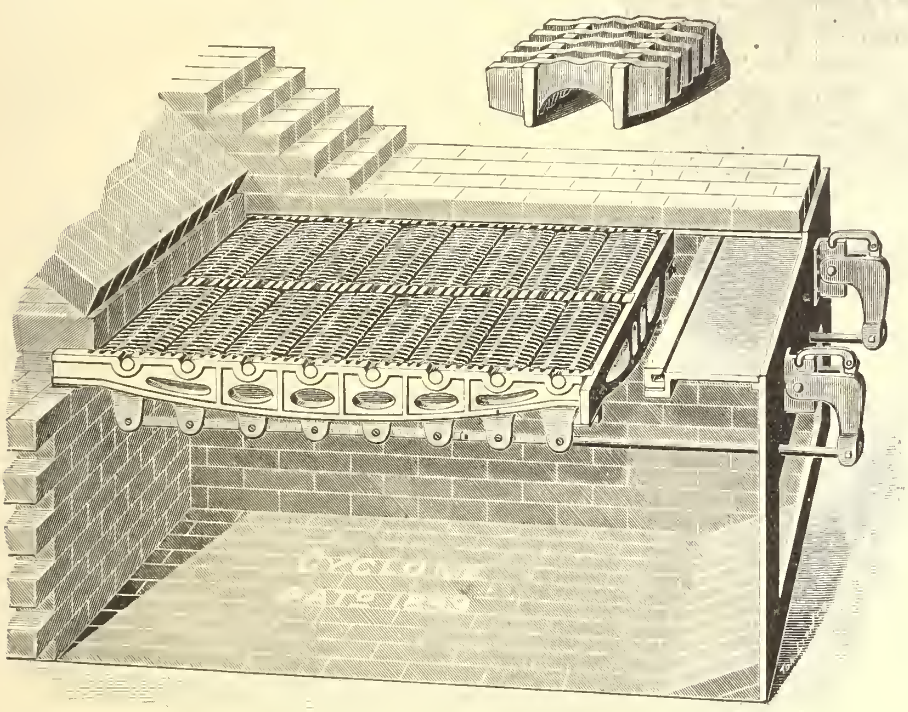
A gentleman who resides out of town during the summer months entered an electrical store the other day to get a figure for a couple of telephones and cable sufficient to connect them, one each side of a small river, virtually a canal. The gentleman wished to call his man with his boat to row him over to his house on arrival of the train. Naturally, the job was expensive, as the cable had to go under water, and the pseudo-customer was aghast. He was then asked: "What's the matter with a tin horn?" The very simplicity of the idea did not seem to have struck him; needless to say it was adopted, and no "grounds" or "short-circuits" have been reported.

THE CYCLONE GRATE BAR.

PRESUMING the majorty of our readers to be interested in methods of economizing fuel, we present herewith some particulars of the Cyclone grate bar, one of the most improved devices for this purpose. In the invention and manufacture of this device, the fact has been kept in view that an enormous waste of fuel is constantly taking place by reason of the escaping of the carbonic oxides of the fuel. This is the result of inperfect combustion caused by imperfect draught, comhustion chambers and bridge walls in boilers, together with imperfectly managed fires. While the inventor and manufacturers of the Cyclone grate bar do not claim it to be a smoke consumer, they do claim to reduce by from 40 to 65 per cent. the amount of carbonic oxides escaping through the chimney, which is a proof of its value as a fuel economizer.

It is claimed for this grate that it embodies the three most essential qualities, namely, durability, simplicity, and economy of fuel. An examination of the accompanying illustration will, it is believed, show these claims to be well founded. The air is passed up and through the grate without a break in the current. There are no complicated parts to obstruct the draft and get out of order, while the sifting movement alone with the downward and backward movements cuts the ash evenly and cleanly from the bottom of the fire over the entire surface of the grate.

It is not claimed for this grate that it will grind up clinkers and separate them from the unconsumed coal without losing any of the latter material, but that it is so constructed as to prevent the formation of clinkers, by admitting the necessary amount of air through the grate to insure perfect combustion, and cause the heat to pass out of the fire box as fast as it accumulates, instead of allowing it to remain and melt the coal and form a melted clinker that no grate could break. It has been found in practice that the weight of air required to support combustion is much larger than that theoretically required in order to effect complete combustion. Complete combustion can be obtained with a supply of air not less than 50 per cent. in excess of the quantity necessary for theoretical combustion with natural draft, but it is usual to provide double the quantity of air theoretically required.



THE CYCLONE GRATE BAR.

This grate is especially adapted to burn cheap fuel, soft and hard coal, screenings, etc., and for use in marine boilers. Among the claims made for it by the manufacturers are the following:

It is the best draft grate in the market; has no rockers and no complicated parts to get out of order underneath the bar or obstruct the draft; the rolling and lifting movement when shaken keeps the air space open and causes no friction on the draft passing through the bar; has ninety per cent. under draft; the frame locks together without bolts, and is easily placed under boiler; will not lock in frame, will not bind in frame; always shakes freely; space in ash-pit same as in ordinary bar, which is four inches; is a perfect bar for all internal fire boilers, no part is in the way to prevent the fireman cleaning out the ashes; the air s passed through and over top of fram e—keeps frame cool and prevents warping; all parts of the bar and frame are trussed and bridged; will burn the cheapest fuel with the best results; will evaporate more water per pound of coal than any other device; is level at all times when locked; no bars stick up in fire and burn off; will not break boiler front when shaking.

This important fuel-saving device is manufactured by the Cyclone Grate Bar Company, 10 King St. West, Toronto, who will be pleased to furnish, on request, to any of our readers further information with regard to it. The attention of readers is also directed to the company's advertisement in this issue, and to the testimonial of the Canadian Pacific Railway Co. appearing therein.

PERSONAL.

Mr. J. A. Hicks, graduate of the Canadian General Electric Company's works at Peterboro, Ont., has recently been appointed inspector for the Royal Electric Company in Montreal.

Mr. J. Eastland, who for six years has held the position of foreman of the London Electric Company, of London, Ont., has removed to Detroit, where he has secured a lucrative position with the Bell Telephone Company of that city.

Mr. Granville C. Cunningham, formerly manager of the Montreal Street Railway, but who later was associated with the street railway at Birmingham, Eng., has accepted a position as manager of the London Central Electric Tramway Co., of London, Eng.

Mr. James Wallace, road-master of the Toronto Railway, has been appointed to a responsible position in connection with the management of the Winnipeg Street Railway, and left for that city a fortnight ago. Mr. Wallace had been in the service of the Toronto Railway Co. for many years.

Mr. A. F. Nash, of Windsor, Ont., has been appointed inspector of electric light and gas for the London district, as successor to the late Mr. Williams. Mr. Nash was for a number of years manager of the Windsor Gas Co., and also owned the electric light plant before it was purchased by the city.

By invitation, Mr. Frederic A. Hamilton, electrical engineer, Halifax, N. S., paid a visit to Mr. Marconi on board the steamship La Grand Duchesse on the occasion of the International yacht race at New York. Mr. Marconi very kindly transmitted a telegram for Mr. Hamilton from that vessel when off Sandy Hook to Sir Sanford Fleming, as follows:—"Off Sandy Hook light-ship—this is a wireless message." We regret to learn that Mr. Hamilton has recently been incapaciated by illness from attending his usual duties, but is now on the way to recovery.

Among recent visitors, the ELECTRICAL NEWS had the pleasure of a call from Mr. Thos. H. McCauley, of Port Arthur. Mr. McCauley is local manager at Port Arthur for the Bell Telephone Co., and superintendent of the Port Arthur Electric Street Railway and Light Systems, which are the property of the municipality. Mr. McCauley spent a couple of weeks in the east, during which he visited a number of the most interesting electrical installations, including that of the Cataract Power Co., the Chambly Mfg., Co., and the Lachine Rapids Hydraulic & Land Co. The municipal authorities of Port Arthur are at present considering the question of operating their plant by water instead of steam. The belief is that by making the change a saving of several hundred dollars per month could be effected in the fuel account.

The Massey-Harris Company, of Toronto, have placed their order with the Canadian General Electric Company for a complete switchboard outfit for their new plant.

Incorporation has been granted to the Renfrew Electric Co., Limited, of Renfrew, Ont., to carry on the business of supplying electric light and power. The directors are A. A. Wright, Chas. Wright, Howard Wright, A. H. Hough and William Ringseben.

TELEGRAPH and TELEPHONE

C. P. R. TELEGRAPH APPOINTMENTS.

A SUCCESSOR to Mr. Chas. Hosmer, manager of the C. P. R. Telegraphs, has been named in the person of Mr. James Kent, whose portrait appears herewith. Mr. Kent entered the service of the Montreal Telegraph Co. as messenger shortly after leaving school in 1868. He soon became an operator, and after working at such for five years was appointed night chief, and subsequently day wire chief. The latter position he held until 1886, when he resigned to accept the position of chief operator of the C. P. R. Telegraphs at Montreal. In 1890 he was promoted to the superintendency of the Eastern division of the same system, which position he held until receiving his present appointment.

Mr. Kent is succeeded as superintendent of the Eastern division by Mr. W. J. Camp, with headquarters at Montreal, while Mr. A. W. Barber, local manager at Toronto, becomes superintendent of

MR. JAMES KENT.

the Ontario division. Mr. C. S. Jenkins, superintendent at Winnipeg, is given the superintendency of lines west of Fort William, with head office in Winnipeg. All the appointments are well deserved.

MARCONI'S WIRELESS TELEGRAPHY.*

By W. B. BRADFIELD.

As is, of course, well known, the Marconi system is worked by means of Hertzian waves, so called after the late eminent German professor, Hienrich Hertz, who first experimentally proved their existence 30 years or so after Clerk Maxwell had mathematically predicted them.

At his New Jersey station Mr. Marconi employs the following apparatus to generate and collect these waves: The first thing that is apparent to the observer is a tall mast, 150 feet high, from the top of which is suspended a wire—it is actually an ordinary insulated copper wire, such as is used for electric-lighting purposes—which passes through a window of the operating room and is joined up inside with the apparatus. There is nothing strange in the appearance of the mast itself, and no effort is made to clothe this part of the apparatus with mystery. With regard to apparatus within the room, simplicity is the most amazing part of it. The whole apparatus is fixed on a small table about four feet long and two feet wide, and the battery for supplying the power is packed underneath it.

This battery consists of 98 dry cells, which are connected up 14 in series, and seven in derivation, and is joined up in parallel with eight accumulator cells to give a steady current of six amperes. The actual generator of the waves is an ordinary inductor or Rhumkorff coil, such as is used for the production of X-rays, and is capable of giving a 10-inch spark. Each end of the secondary winding of this coil is fitted with a sparkling rod, to which is attached a brass ball 1½ inches in diameter.

To one of these balls is connected the vertical wire; the other is joined to earth. With the single addition of a Morse key in the primary circuit the transmitting apparatus is complete.

* From the New York Herald. Mr. Bradfield is Mr. Marconi's assistant.

Consider for a moment what happens when this key is depressed. The immediate and apparent result is a loud, crackling spark discharged between the two brass balls which are adjusted to be about two contimeters apart. The more important result is that the vertical wire at the moment the spark passes emits waves which go out into space in all directions, and continue to do so as long as the key is depressed. It is quite easy to understand, therefore, that by depressing the key for a short or a long period short and long series of waves or oscillations are emitted, and the Morse alphabet, which is used in ordinary telegraphy, may be employed.

The only thing that remains is to get something that will pick up and indicate the presence of these oscillations.

The apparatus which Marconi employs to do this is what is commonly known as a "coherer," a name which is due to Professor Oliver Lodge, of Liverpool. An Italian, named Calzecchi, was the first to discover the sensibility of coherers and fiilngs tubes to Hertz waves. He found that metallic filings in a loose state of contract offered an appreciable resistance to the passage of a current. He found, also, however, that on exposing these filings to the action of Hertzian waves the resistance fell enormously, but that on shaking them up the resistance was increased again to its original value. Marconi's coherer works on on the same principle, but is vastly more sensitive aud reliable than those used by Calzecchi, Branly and others.

It consists of a small glass tube about two inches long, in which two small silver plugs a quarter of an inch long are tightly fitted and separated from each other by about one-thirtieth of an inch, the gap between them being partially filled with a mixture of nickel and sllver filings, these metals having been found to be the most sensitive and reliable after a long series of experiments. The coherer is exhausted to a vacuum of four millimeters.

So much for the coherer. The rest of the receiving apparatus is perfectly easy to understand. In circuit with the coherer is a single dry cell and a telegraphic relay of the ordinary type. This relay is used to close the circuit of a local battery, which works a Morse writing instrument, and also an electric bell hammer, which strikes the coherer a smart tap to restore it to its normal high resistance after it has received an impulse from the distant transmitter.

To protect the coherer from the too powerful effects of the local transmitter the whole receiver is enclosed in a metallic box.

To receive a message all that is now necessary is to connect the vertical line either directly or through a small induction coil to one end of the coherer, the other end of it being connected to earth.

Such is the Marconi apparatus in use at the Herald's New Jersey land staton, and it is in exact duplicate aboard the steamer Ponce. She has been specially rigged with a new topmast to give the same height of wire as that at the land station, and the instruments are installed in the chart house.

The distance that will have to be bridged will probably not exceed 35 miles; the apparatus employed would, however, be capable of sending and receiving messages at a distance of nearly 80 miles.

The chief factor in determining the distance possible is the height of the vertical wire. Mr. Marconi finds that by doubling the height the distance becomes quadrupled. That is, assuming 20 feet will give one mile, 40 feet will give 4 miles, 80 feet 16 miles, and so on. There are, of course, other factors, such as the sensitiveness of the coherer and the adjustment of the apparatus generally, but apparently they are not so marked in their effects.

Why this vertical wire is necessary for long distances is not very certain. It has been suggested that the earths curvature may have something to do with it. Compare this, however, with Mr. Marconi's results in the English naval manoeuvres this summer, when with 150 feet of wire at each end he succeeded in telegraphing 75 miles. To do this the waves must have passed through a "hill" of water 35 miles long and 700 feet high. More probably, the vertical wire is necessary because its use lengthens the waves and propogates them in a plane vertical to the surface of the earth, and they are, therefore, less likely to be absorbed by it. The fact that the waves are lengthened, of course, causes them to be more penetrative and capable of effecting a receiver at a greater distance

Of the working of a wireless-telegraph station there is not much to say, as it is ssentially the same as that of any other telegraph office. At present the speed of transmission is rather less; it does not ordinarily exceed about 15 words a minute, but this will, of course, increase with time. A call is indicated by a bell which is switched off during the reception of a message. As before

stated, the telegrams are printed in dots and dashes on an ordinary Morse inker, the operator having merely to read them from the tape.

The key used is of a slightly different form from the usual Morse key, the back contact being used to connect the vertical wire to the receiver, so that no changing over from the transmitter to the receiver is necessary after sending a message.

[This article was referred to editorially and intended to have been published in our November issue, but was inadvertently omitted.—THE EDITOR.]

AUTOMATIC TELEPHONE EXCHANGES.

AN English contemporary gives an interesting description of the automatic telephone system controlled by the Direct Telephone Exchange System of London. In the case of a small exchange of one hundred subscribers, such as would be used for a small town or in a large office or hotel, the subscribers would be nnmbered from 101 to 199. The instrument (Fig. 1) which each subscriber has is very similar to an ordinary telephone set. In front there is a rotating disc D provided with holes numbered 1, 2, ... 0. Suppose that a subscriber wants to make connection with No. 139. He inserts the tip of his finger in 1 and pulls the dial round until his finger reaches the stop S; he then

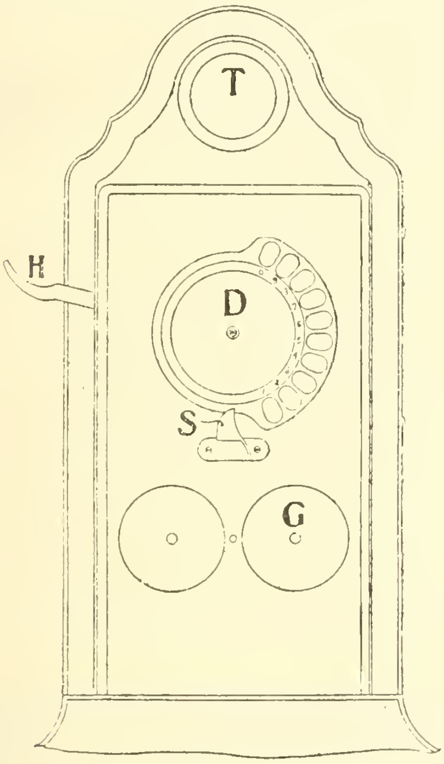


FIG. 1.

lets it go, and it automatically rotates back to its original position. He next does the same operation at 3 and then at 9. This makes connection between his telephone and that of No. 139. He now rings his magneto bell in the ordinary way, and if his own bell G rings at the same time, he knows that No. 139 is not engaged; if, on the other hand, his own bell does not ring, he knows that it is engaged. In the former case he takes his telephone off the hook H and talks into the transmitter T. Whilst he is talking with No. 139 it is impossible for any one else to ring either of them up. When the conversation is finished the mere act of hanging up the telephone on H moves their switches at the exchange back to their normal positions and so leaves them both ready to be called up by any other subscriber.

It will be seen that all the exchange work is done by the subscriber himself, the time required to do it being only from three to five seconds. Again, as they are not at the mercy of the exchange girl, the conversation is absolutely secret, and cannot be interrupted except at the option of those talking.

From each subscriber's telephone two wires go to the central station, and the electric impulses that are sent along them operate the apparatus at the exchange. The mechanism of the dial on each telephone is not unlike that of the apparatus used in messenger call systems. Turning round this dial winds up a spring, which, as it runs down, operates a toothed wheel, and so sends a definite number of electric impulses along the line. The tension of the spring admits of easy adjustment, and there is a governing arrangement to regulate the speed. At the exchange there in an elaborate switch for each subscriber, which he alone can operate by his dial, and only when this switch is in its normal position can he be called up. Although highly elaborate, the design of this switch is sound, and occasional attention from a mechanician would be sufficient to keep it in thorough working order. Part of it consists of a concave surface (fig. 2) formed of plaster of Paris in which is embedded a number of contact pins corresponding to the number of subscribers, each of which is in connection with a subscriber's wire. In the figure, part of one of the hundred switches in a hundred exchange is shown. It will be seen that there are ten rows, and ten contact points in each row. The arrangement of the contact pins in the insulating material is also shown.

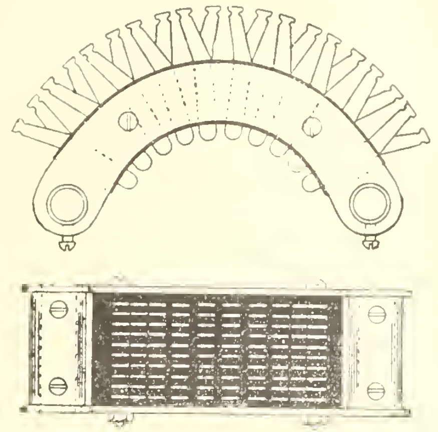


FIG. 2.

In the axis of the cylinder of which this surface is a portion there is a rotating axle carrying a radial contact peice or wiper, which can be made to have contact with any of the contact pins. The first current impulse sent over the line brings the wiper into position, one tooth behind the first pin. The second series of impulses raises the rotating axle so that the wiper comes opposite the required tens line. In the case supposed it would be raised so that it was opposite third row. The third series of impulses rotates the shaft bodily, so that the wiper comes in connection with the ninth pin on the third row. The subscriber is now through to 139. The fact that these two are in talking connection does not interfere with the other subscribers, except in so far that neither of them can be called up by any one until they have finished their conversation. It would be quite possible for ten or twenty different calls to be accomplished at the same time, as the action of each switch is practically independent, and the accumulators at the central station can supply a large current.

The automatic exchanges are built in three sizes: the first includes the 100 to 400 system in which only a single switch is used for each subscriber. The second and third, which are for 1,000 and 10,000 subscribers respectively, need two switches per subscriber. In the larger exchanges the "bridging system" is used. In this the electro-magnets do not form part of the talking circuits, and so they can be made of relatively high resistance and consequently can be operated by a smaller current. Inh the ordinary exchange each subscriber takes about 0·5 of an ampere to operate his switch, but when the bridging system is used 0·2 of an ampere is ample. To give an idea of the size of each switch, it may be mentioned that in a 200 exchange each switch occupies a lineal space of 12 in. by 4 in. and projects 6 in. from its base. It is stated that a room 40 by 45ft. in floor space is large enough for a 5,000 exchange. It is also stated that one man can look after 1,000 instruments. When it is remembered that in an ordinary manual exchange one operator can only attend from 50 to 100 subscribers, there is an obvious economy in labor.

SHORT CIRCUITS.

The Citizens Telephone & Electric Company, of Rat Portage, Ont., has installed a new telephone switchboard.

The residents of Danford Lake, Que., purpose forming a joint stock company to build a telephone line from Danford to Kazubazua Station.

Doctors Paul and Eckhert, of Sebringville, Ont., have obtained right of way to erect a telephone line from that place to Avonton and Carlingford.

The Pennfield & St. George Telephone Company are building a telephone line from St. George to Black's Harbor, Beaver Harbor and Pennfield, N.B.

Incorporation has just been granted to the Carman Telephone Exchange Co., composed of merchants of Carman, Man. The company purpose building a telephone system.

The Dominion Government are believed to have decided to adopt the wireless telegraphy system between the Labrador coast and Belle Isle, where the steamer Scotsman was wrecked.

Messrs. James Kent, superintendent, and W. J. Camp, electrician C. P. R. Telegraphs, returned to Montreal last month, after having fitted up the new telegraph office at Vancouver.

Mr. D. Budge, of Halifax, has been appointed general superintendent on this side of the Atlantic of the Halifax & Bermuda Cable Co. and the Direct West India Cable Co. His headquarters will be in Halifax.

The North-Western Telephone Exchange Co., which controls the long distance lines in the North-West, has given notice that the company has decided to extend its system to include the line of the Great Northern road to St. Vincent.

The British Columbia Telephone Co. intend to connect Victoria and Vancouver, a distance of 26 miles, by a telephone cable. This cable will be equal in length to the longest submarine cable in the world, that between England and France, crossing the English channel.

ELECTRIC RAILWAY DEPARTMENT.

THE METROPOLITAN ELECTRIC RAILWAY.

For some years previous to 1890 the Metropolitan Railway Company operated a horse car line on Yonge street from the C.P.R. tracks at the northern city limits of Toronto to Glen Grove, a distance of two and three-quarter miles. In that year electricity was substituted for animal power for the propulsion of the cars, the power house being situated about midway between the two terminals of the road, and current being furnished by a Thomson-Houston dynamo. Gradually extensions were made northwards, and in 1897 the line had reached Richmond Hill, a distance of fourteen miles. Encouraged, perhaps, by the success of this extension, the company concluded to undertake further extensions which had been under consideration, and during the past summer the line was completed and put in operation as far as Newmarket, a distance of about thirty miles. The route for almost the entire distance follows the public highway of Yonge street, and passes through a chain of suburban villages and country residence districts, as well as the town of Aurora. In order to obviate possible objections by any municipality, the company secured the passing of an act whereby the whole of Yonge street north of the C.P.R. tracks was placed in the control of the county of York. It is understood to be the intention of the company to eventually reach Lake Simcoe.

Fig. 1.—Power House.

The system of the Metropolitan Railway Company presents many interesting features. One of these is the unusually heavy grades encountered; another the method of generating and distributing the current, which we believe represents an entirely new practice in street railway operation in Canada.

THE POWER HOUSE.

The extensions to the road necessitated the erection of a new power house, for which Nature had provided an ideal site. About twenty miles from the southern terminus of the road, Yonge street converges slightly to the west for the purpose of rendering unnecessary the crossing of a valley. In this valley, and occupying almost the total area, is situated Bond's Lake, which covers an area of forty-eight acres and has a depth at some points of over 100 feet, and around which the land rises to a considerable height, making a very picturesque view. It is in this valley, and bordering on the lake, that the new power house is located, the top of the building being but a few feet above the level of the land. The advantage of this location is that an unlimited supply of water is always obtainable for condensing purposes without the necessity of pumping.

The power house, shown in Fig. 1, was designed by Messrs. Gordon & Helliwell, architects, of Toronto, Mr. John Aldrich being the contractor for labor and the Metropolitan Company supplying all material. It is an imposing white brick structure, with stone foundation and iron and slate roof. The floor is of concrete supported by steel girders, and the window frames and sashes are of cast iron, the object of the company being to erect an entirely fireproof building. Owing to the advantageous location, very little excavating was necessary. The building has a white brick chimney, with 23 feet base, towering to a height of 125 feet. The boiler room, 50 x 47 feet, is situated directly to the south of the engine room, from which it is separated by a brick partition wall. The engine room is 74 x 90 feet, and affords an abundance of room. It is unusually well lighted, having 15,000 feet of window surface.

The boiler room contains a battery of four steel return tubular boilers, 73 inches in diameter and 16 feet in length, with ninety $3\frac{1}{2}$-inch tubes. The boilers, which are of the Goldie & McCulloch Company's well-known make, are fitted with Jubilee shaking bars, manufactured by the Jubilee Grate Bar Company, of Toronto, and are connected to a steam main, from which there is a branch to each engine. The total boiler capacity of 700 h.p. will, it is expected, be sufficient to meet the demands for some time to come. Water is fed to the boilers by two duplex boiler feed pumps, 6 x 4 x 7, manufactured by the Northey Manufacturing Company, of Toronto, and there are two Northey jet condensers, 10 x 15 x 15. When connection is made with the C.P.R., as intended, railway freight cars will run close to the power house, from whence the coal will pass by means of a chute direct into the boiler room.

The engine equipment consists of two cross compound Wheelock condensing engines, furnished by the Goldie & McCulloch Company. They have a capacity of 350 h.p. each, running at 86 revolutions per minute. The high pressure cylinders are $17\frac{1}{2}$ inches in diameter, the low pressure cylinders 32 inches in diameter, with a stroke of 42 inches. The massive pulley fly-wheels are 18 feet in diameter and 42 inches in face. A view of the engines is shown in Fig. 2, the second engine appearing in the background. These engines, with their accompanying generators, take up little more than half the space in the engine room, the balance being reserved for additional equipment whenever the traffic of the road shall demand it. The floor is not yet completed, as will be seen by the illustration.

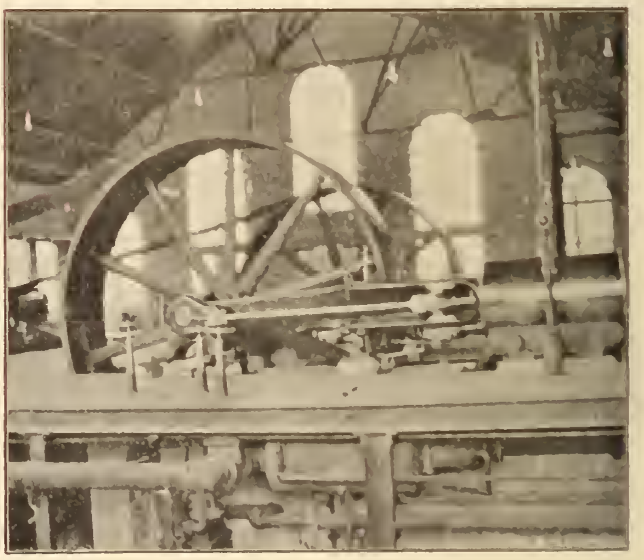


Fig. 2.—Pair of Compound Engines.

Each engine drives one 275 k.w. A.C.D.C. 60-cycle three-phase multipolar generator, connected by means of a 40-inch belt supplied by the Beardmore Belting

Company, of Toronto. These generators, operating at 600 r.p.m., give 550 volts direct current on one side and 350 volts alternating current on the other. The direct current is fed direct to the line and used to operate the section of the road from the power house north to Newmarket, a distance of about 10 miles. The alternating current is delivered to 500 k.w. static transformers, of which there are four, wound for 400 volts primary, situated in the power house, where it is stepped up to a pressure of 16,500 volts. It is then conveyed by the

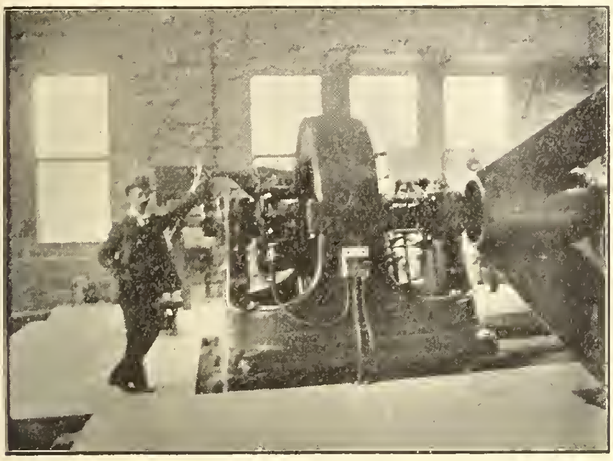


FIG. 3.—ONE OF THE GENERATORS.

three-wire system a distance of 16 miles to the sub-station at York Mills, where it is passed through step-down transformers and rotary converters and reduced to 550 volts direct current, at which it is delivered to the line for operating the southern portion of the road.

The generators above referred to are of the Westinghouse make, and are separately excited by means of exciters belted from the shaft of the generator. The step-up transformers were also manufactured by the Westinghouse Manufacturing Company and are of the self-cooling oil type. Paraffine oil is used, and has been found very satisfactory.

The switch-board in the power house is of marble, mounted on an iron base, and stands six feet from the wall, giving access to all connections back and front. It is 16 feet wide and 8 feet high, and contains eight

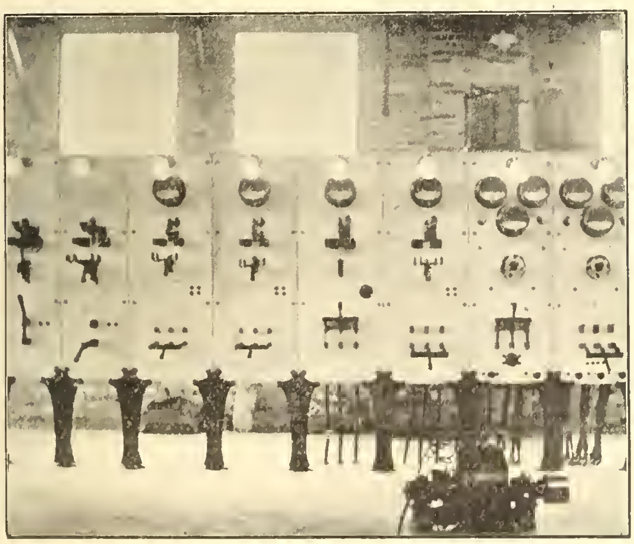


FIG. 4.—GENERATOR SWITCHBOARD.

panels, of which two are alternating current, four direct current, and two double feeder panels. There are in all 13 meters, including 10 ammeters, one direct current volt meter and two alternating current volt meters, the volt meters being hung on swinging brackets so that they can be moved to be visible from all parts of the room. On each panel there are the necessary high tension fuse switches and circuit breakers, and on the back a No. 3 type R 15,000 volt lightning arrestor and one railway tank lightning arrester connecting between the line and the switchboard.

A general view of the switchboard is show in Fig. 4.

The old power house has been closed, and it is the intention to remove the direct current machine therein to the new station at Bond Lake.

THE SUB-STATION.

The sub-station is located at York Mills, about four and one-half miles from the southern terminus of the road. It is 30 feet wide and 45 feet long, of red brick, but in other respects its construction is very largely a duplicate of the power house.

Its equipment includes four 100 k.w. static transformers wound for 16,500 volts primary and 400 volts secondary. The current is received into these transformers from the power house at 16,500 volts alternating and reduced to 350 volts. At this pressure it is delivered to two 200 k.w. three-phase rotary converters, where it is changed to 550 volts direct current. These converters are operated at 710 r.p.m. and each are excited on one side by an induction motor of 25 h.p., a synchronizing motor for operating the plant being on the other side. The current thus produced is utilized to operate the southern portion of the road, that is, from the C. P. R. tracks to the power house, a distance of about 20 miles.

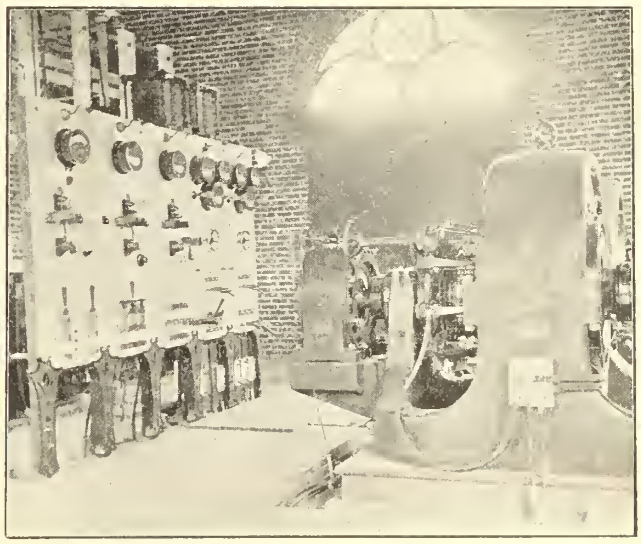


FIG. 5.—INTERIOR OF SUB-STATION.

The switchboard in the sub-station is of marble, containing five panels, two for alternating current for operating the machines, two containing equipment for direct current, and the fifth containing two automatic circuit breakers connected into the line. The first two panels contain three A. C. ammeters, rheostat for controlling the current and switches for controlling the starting motor and the synchronizing motor, all of Westinghouse make. The next two panels contain one D.C. ammeter, one D. C. circuit breaker of latest type, and a three knife switch. The fifth panel contains two circuit breakers, two single knife switches and Weston volt meter. The switches are of the latest type of automatic quick breaking. The equipment of the sub station includes also a 15,000 volt lightning arrester and a Westinghouse tank lightning arrester. The apparatus enumerated occupies but one-half the space in the station, the balance being reserved for additional equipment, if found necessary.

THE POLE LINE.

The poles are of cedar and are set 100 feet apart. They are 38 feet in length, 6 inches at small end, with suspension trolley arms. The insulators are of the ordinary porcelain pattern, and were manufactured by the Imperial Porcelain Works, of Trenton, N.J., and tested to a pressure of 40,000 volts. They are placed 15 inches apart. The high tension line is of No. 4 covered copper wire made by the Montreal Rolling Mills Company. Since the plant was put in operation no trouble has been experienced excepting on one occasion,

when, during a heavy east wind, the branches of a poplar tree were blown over the line, causing the two wires to touch and blowing out the circuit breakers in the station. The trolley wire is No. 2 0 and the feed wire No. 4 0 bare copper, with a feeder into the trolley wire every tenth pole. Switches are so arranged that should necessity demand, the road may be entirely operated from either the power house or sub-station.

THE ROAD BED.

As previously stated, the line follows the Yonge street thoroughfare. The construction of the road represents the best engineering practice. There is a ballast of about six inches under the ties, which are of cedar and tamarac and placed about two feet apart. The track is covered in with gravel and ordinary earth. The rails are of the ordinary T pattern, 56 pounds to the yard, bonded to each other with No. 4 0 copper bond and cross-bonded every one thousand feet. It is a single track, with 13 spring switches, which are always open to a car running towards them. The track is placed on the side of the road, so that the ties will just clear the ditch. From the city limits to York Mills it is on the west side, and for the balance of the distance on the east side, it being found that this plan would give the least interference by snow. The track practically follows the grade of the road, the southern portion near the city being fully three inches below the level of the crown of the road, and further north on the

FIG. 6.—BALDWIN-WESTINGHOUSE ELECTRIC LOCOMOTIVE.

level with the crown. Box drains are provided for carrying away the water.

The road leaves Yonge street at two points. At Aurora it makes a detour to the west in order to cross the G.T.R. by an overhead steel trestle bridge 125 feet in length, built by the company. The seeond time is at the side-road at Hon. Wm. Mulock's residence beyond Aurora, where it cuts diagonally across private property for one and one-half miles, and thus reaches the town of Newmarket, where it passes up the centre of the main street. Besides the bridge mentioned, there are two steel girder bridges over the Holland river north of Aurora and a steel bridge 100 feet in length over the Don river at York Mills, all calculated to carry a load of the heaviest steam railway coal cars covering the entire bridge. These bridges were also built by the company.

During the summer the gauge of the road-bed was changed from 4 feet 10¾ inches to the standard gauge of 4 ft. feet 8½ inches. This was done done to permit connection with the C.P.R., it being the intention to connect with that road at North Toronto.

THE GRADES.

The grades on this road are, it is believed, more severe than on any other suburban electric railway in Canada. Starting at the southern terminus the first grade is encountered at Gallow's Hill, it being a north-bound grade of seven per cent. for a distance of 260 feet. At the old power house, about one mile further, there is a south-bound grade of five per cent. for a distance of 132 feet and a north-bound grade of 6.2 per cent. At York Mills, four miles from the southern terminus of the road, there are south-bound grades of 6.4 per cent. for 400 feet and 6.8 per cent. for 700 feet, and one-half mile further on, at the North York Mills hill, 200 feet of 6.2 per cent., 200 feet of 6.4 per cent., 300 feet of 5.8 per cent. and 400 feet of 6.35 per cent., all north-bound grades. At Willowdale there are 1,300 feet of 2.6 per cent. north-bound grade, and at Morgan's Hill, three miles further on, 400 feet of 5.7 and 400 feet of 6.1 per cent. south-bound grades. The steepest grades are found at Thornhill, where there are 100 feet of 5, 100 feet of 6.3, 100 feet of 8, 100 feet of 7.3, and 100 feet of 4.7 per cent. south-bound, and 100 feet of 4.8, 100 feet of 7.8, 200 feet of 8, 300 feet of 7.35, and 100 feet of 5.1 per cent. north-bound grades. At Richmond Hill there is a north-bound grade of 4.25 for a distance of 1,800 feet. Although the main ridges are crossed above Richmond Hill, none of the grades exceed those above given. There are six north-bound grades, varying from 4½ to 5½ per cent. and from 400 to 1,000 feet in length.

ROLLING STOCK.

The company is well provided with rolling stock, having 19 passenger cars built by the Pullman Company and recently overhauled by the company's own mechanics. These cars are double vestibule, heated by coal stoves, and with one exception are mounted on single trucks. Each single truck car has two 30 h.p. motor equipment, the double truck car having four 30 h.p. motors. Five of these equipments are Canadian General and the remainder Westinghouse. They have also four flat cars for hauling local freight. These will be drawn by a Baldwin-Westinghouse electric locomotive of 200 h.p., of which an illustration appears herewith. This locomotive has 33 inch driving wheels, wheel base 16 feet, length over platform 22 feet, and its total weight is 54,700 pounds. It is fitted with four standard 38 B 50 h.p. motors, together with special controllers.

NOTES.

The entire electrical equipment of the system, including the electric locomotive, was furnished by the Westinghouse Manufacturing Company, of Pittsburg, Pa., and installed by the United Electric Company, Limited, of Toronto. The plant is modern in every respect, and notwithstanding the great fluctuations of load caused by steep grades, its operation has been found satisfactory.

Mr. James McDougall, C.E., was engineer in the interest of the county of York and prescribed grades and alignment and looked after the details of construction in that behalf. Mr. W. T. Jennings, C.E., also acted as consulting engineer in a semi-private capacity.

The president of the road is Mr. C. D. Warren, and the superintendent and manager Mr. J. W. Moyes. Mr. Moyes has held this position for about eight years, he having had charge of the road when it was a horse car line. The chief engineer is Mr. John W. Marr, who has been with the company for two years. Previous to accepting this position he was employed by the T. Eaton Company and the Toronto Incandescent Light Company. Messrs. Joseph Lappin and John Mitchell are electricians at the sub-station.

At Bond Lake the company have built a stone, brick and iron car barn, 90 x 36 feet, capable of housing nine cars. The balance will be stored in the old car barn at Deer Park.

The company have purchased 400 acres of land and an hotel at Bond Lake, and it is the intention to establish picnic and camp grounds.

The company have been given the contract for carrying two mails per day each way between Toronto and Newmarket.

Notwithstanding the heavy grades the cars average a speed of about 20 miles per hour without difficulty. A 15 minute service is provided between Toronto and Glen Grove, and between Toronto and Newmarket there are on an average eight cars daily each way.

ENGINEERING and MECHANICS

POWERS, ROOTS, AREAS AND SURFACES.*

By C. R. T. Fessenden.

As engineers have much to do with measuring areas, surfaces, and volumes, a knowledge of powers and roots is necessary.

Powers.—When a given number is multiplied by itself, and the product multiplied again by the number, and so on, these products are called powers of the given number, and what power, or the number of times the given number is used as a factor, is shown by a smaller number written above and to the right; thus 5^2, read five squared, means 5×5, or 25; 5^3, or five cubed, means $5 \times 5 \times 5$, or 125; 5^4, five to the 4th. The 2nd power is called square, and the 3rd the cube.

Roots.—A square root of a given number is that number which, multiplied by itself, will yield the given number. Cube root is that number which, used as a factor three times, yields the given number; and if two numbers are given, the first being a power of the 2nd, then the 2nd is that root of the first, viz., 5 and 25; 25 is the 2nd power or square of 5, and 5 is the 2nd root or square root of 25. When the root of a number is indicated the sign $\sqrt{}$ is used. As used alone $\sqrt{25}$ means square root, any other root being shown by a number placed thus, $\sqrt[4]{625}$, reads 4th root of 625. To extract or find the square root of a number, divide it into groups of two, counting from the decimal point. If the last group to the right of the decimal is incomplete, a cipher must be affixed to make it complete. Thus the number 9158.49 is divided into groups of 58, 91 and 49.

```
            9158.49 | 95.7
            81
    180   | 1058
      5   |
    185   |  925
       1900 | 133.49
          7 | 133.49
       1907
```

Then set down as first figure of root the largest number whose square is not greater than the left hand or first group (1st group 91, largest number 9); place its square (81) under first group and subtract $(91-81=10)$. Bring down next group (58), making a dividend (1058). Multiply the root so far obtained by 20 for a trial divisor $(9 \times 20=180)$, divide dividend by trial divisor and place quotient (5) as next figure of root, also add it to the trial divisor $(180+5=185)$; multiply sum of trial divisor and last root figure by last root figure $(185 \times 5=925)$, and subtract from trial dividend; to the remainder (133) annex next group, which is a decimal, ∴ place decimal (.) in root, multiply root (95) by 20, and proceed as before. If there is a remainder, bring down groups of ciphers, always remembering when you come to decimal point to place it in the root.

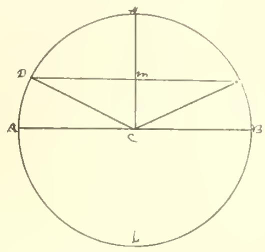
To extract $\sqrt{}$ of vulgar fraction reduce to a decimal, unless both numerator and denominator are perfect squares, when their $\sqrt{}$ may be written down as $\sqrt{\frac{9}{16}}=\frac{3}{4}$, $\sqrt{\frac{1}{2}}=\sqrt{.5}=\sqrt{.50}$.

```
             480048.687 | 78.3
             343
    14700  | 137048
     1680  |
       64  |
    16444  | 131552
    1825200 | 5496687
       7020 |
          9 |
    1832229 | 5496687
```

To extract cube root point into groups of three figures, beginning at decimal point; place in root the largest number (7) whose cube is not greater than first group (480), placing its cube (343) under first group. Subtract, and to the remainder (137) bring down next group (048.), making a dividend of 137048. Next, for a trial divisor take 300 times the root squared $(7^2 \times 300=14700)$, divide, and place quotient (8) as next figure of root; multiply root by last figure added and multiply product by 30 $(7 \times 8 \times 30=1680)$, which add to trial divisor, also add square of last figure $(8^2=64)$. Multiply this sum (16444) by the last figure of root (8); subtract from dividend 137048, and to the remainder bring down next group (.687), placing decimal in root; square 78 and multiply by 300 for trial divisor (1825200); quotient is 3; place in root and multiply root 78 by 3 and product by 30 $(78 \times 3 \times 30=7020)$. Add last root figure squared (3^2 or 9), making 1832229; multiply by last root figure, and proceed as before. If remainder of the last group is brought down, bring down groups of ciphers.

In case other roots are wanted than square and cube, it is necessary to use a table of logarithms, except $4\sqrt{}$, which is the square $\sqrt{}$ of the square $\sqrt{}$.

Areas and Volumes.—The principal figures the engineer uses are circles and cylinders and their parts, and for the volume of cylinders: In the circle A H B the line A B is a diameter, the lines D C, H C and F C are radii; the space inside the line A D H F B L is the area of the circle; the space inside A D H F B is a semi-circle; the space C D H F C is a sector of the circle; the space D F H is a segment; the line D F is a chord; the line D F H is an arc of sector C D H F.



Diameter $\times$ 3·1416 = circumference.

$40 \times 3·1416 = 125·664''$.

Diameter$^2 \times$ ·7854 = area. Suppose circle is 40″ in diameter.

Thus area $= 40 \times 40 \times ·7854 = 1256·64$ sq. in.

Radius$^2 \times$ 3·1416 = area. Radius = ½ diameter.

$20^2 \times 3·1416 = \text{area} = 1256·64$ sq. in.

$\frac{\text{Diameter}^2 \times ·7854}{2}$ = area of semi-circle.

Area of sector is radius × arc and product divided by 2, thus radius = 20, arc = 45, area $= \frac{20 \times 45}{2} = 450$ sq. in. Area of segment D F H = area of sector C D H F C minus area of triangle C D F; area of triangle C D F = chord D F × ½ height of triangle M C (12″). Chord D F $= 35 = \frac{12 \times 35}{2} = 210$ sq. in. Surface of tube = circumference in inches × length in inches. Thus a 3″ tube 12 ft. long is $3 \times 3·1416 \times 12 \times 12 = 1671·3312$ sq. in.

Volumes of cylinders are found by multiplying area of end by length, both in inches or feet; thus a boiler 60″ in diameter by 14′ long, area of end $= 60^2 \times ·7854 = 2827·4$ sq. in.; volume = 2827·4 sq. in. $\times 14 \times 12 = 374763·2$ cu. in. Volume of segment of cylinder = area of segment of end × length; thus steam space in 60″ boiler, water 45″ deep; by rule area of segment of end 15″ deep = 120 sq. in.; length = 14 × 12″; steam space = 120 sq. in. × 14 × 12 cu. in. = 19160 cu. in.

Volume of box = area of end × by length; thus box 8 ft. deep by 4 ft. long by 5 ft. wide $= 8 \times 4 \times 5 = 160$ cu. ft.

* Paper read before Hamilton No. 2, C.A.S.E.

AMONG THE ENGINEERS.

Mr. James Newton has been appointed engineer at the waterworks at Hintonburg, Ont., which were recently completed.

Mr. James May, of Essex, has accepted the position of engineer in the wood-working factory of Gardner Bros., Leamington, Ont.

Mr. Thos. Eversfield, who for upwards of twenty years was engineer at Toronto University, is now representing the James Morrison Manufacturing Co., of Toronto, on the road.

Mr. D. C. McLean, who for many years has been chief engineer at the power house of the Toronto Railway Company, recently resigned to accept a position in Glasgow, Scotland. He has been succeeded by Mr. Thomas Merry.

Mr. Peter Peterson, first engineer in the Canadian Packing Co.'s factory at London, Ont., was caught in the belting while oiling some shafting and instantly killed. Deceased had but recently qualified for the position of engineer.

The employees in and around the power house of the Toronto Railway Company have organized the Toronto Street Railway Company Electrical and Mechanical Association. The main object of the association is to provide sick benefits. The president is Mr. G. J. McCullough, chief electrician, and the secretary Mr. William Cox.

Mr. John Tucker, of Hintonburg, Ont., was almost instantly killed by the explosion of a 15-horse power boiler at the Chaudiere in Ottawa. The boiler was being used to provide power for running a stone crusher, and it is said that there was 60 pounds of steam on and plenty of water in the boiler. Deceased was 90 feet away at the time of the explosion, driving a cart, and was struck by the driving wheel. The jury empanelled to inquire into the circumstances brought in a verdict that the explosion was caused by a deposit of dirt in the bottom of the boiler, which resulted in overheating and consequent sudden expansion. They also found that the by-laws relating to steam boilers had not been enforced, and recommended that the government, in the interest of the general public, appoint a provincial boiler inspector.

The Consumers Cordage Company, of Montreal, have lately improved their engineering department, having put in a Wheelock engine of 250 h.p., low pressure, a Brown low pressure engine of 400 h.p., condensing engine and six steel tubular boilers built by White & Company, of Montreal. The Brown engine was built by the Polson Company, of Toronto, and the Wheelock engine by the Goldie & McCulloch Company, of Galt. When these engines are in operation there will be 700 h.p. installed. The boilers are 75 h.p. The plant is under the supervision of Mr. John Killfeather and Mr. M. Rochford.

SPARKS.

Messrs. Young Bros., of Almonte, Ont., have installed a dynamo for lighting their works.

In Athens, Ont., there is an agitation on foot to install an electric plant for street lighting.

The citizens of Oakland, Man., are endeavoring to secure telephone connection with Portage la Prairie.

The Schofield Woollen Company, Paris, Ont., are installing a 12 k.w. Edison dynamo for lighting their works.

The Maritime Electric Company, dealers in electrical supplies, Halifax, N.S., are reported to have assigned.

A by-law will shortly be submitted to the ratepayers of Nelson, B.C., to raise $7,000 for electric light purposes.

A by-law to raise $7,000 for electric light purposes was carried by the ratepayers of Campbellford, Ont., a fortnight ago.

J. G. Field, of Tavistock, Ont., is installing a 30 k.w. standard alternator of the Canadian General Electric Company's make.

The city council of St. Thomas, Ont., have awarded to the Bell Telephone Co. the contract for supplying a fire alarm system.

The Poorman Mine, Nelson, B.C., is installing a 50 h.p. induction motor of the Canadian General Electric Company's make.

The Toronto Railway Company are adopting electric welding of rail joints, the intention being to apply this method to the entire system.

The Linde British Refrigeration Company have bought from the Canadian General Electric Company one 30 h.p. and one 10 h.p. induction motor.

At the next meeting of the city council of Brockville, Ont., an estimate of the cost of installing an electric plant for street lighting will be submitted.

Mr. A. B. Rice has made application to the town council of Toronto Junction, Ont., for permission to supply electricity for light and power purposes.

The Montague Electric Company, Prince Edward Island, have purchased a 500-light standard alternator from the Canadian General Electric Company.

A committee of the town council of Milton, Ont., have asked the Milton Electric Light Company to state upon what terms they will sell the plant to the town.

The Canadian Colored Cotton Company, of Milltown, N.B., have bought two 55 k.w. multipolar 125-volt generators from the Canadian General Electric Company.

The town of Levis, Que., is about to install an electric light system, for which plans are invited by F. Roy, secretary-treasurer of the municipality, up to January 1st.

The Canadian Pacific Railway has given a contract for one 200 h.p. 550-volt induction motor for the Trail Smelter at Nelson, B.C., to the Canadian General Electric Company.

The Sarnia Street Railway Co., at a recent meeting, decided to take steps at once to convert the road into an electric system. Mr. J. S. Symington is president of the company.

The Callfornia Mine of British Columbia have ordered from the Canadian General Electric Company one 150 h.p. 2,080-volt induction motor for operating their compressor plant.

The Montreal Cotton Company, of Valleyfield, Que., have ordered one more 100 h.p. and six more 50 h.p. induction motors from the Canadian General Electric Company.

Before the Canadian Institute in Toronto Prof. C. A. Chant, of Toronto University, delivered a lecture on wireless telegraphy, with lantern illustrations and instrumental demonstrations.

Tenders have been taken for building a power house for a municipal electric light plant at Halifax, N.S. The city engineer is to furnish an estimate of the cost of electrical equipment.

The Montmorency Cotton Mills Company, Montmorency, Que., have purchased a 60 k.w. direct-connected unit, with Robb-Armstrong engine, from the Canadian General Electric Company.

The St. Croix Gas Light Company, St. Stephens, N.B., have purchased from the Canadian General Electric Company an A.S. 8-120-900-2,080-volt alternator, with exciter and switchboard.

The Arnprior Electric Light and Power Company have been given a contract to light the streets of the town by arc lights. It is understood to be the intention of the company to remodel their plant.

The Penman Manufacturing Company, of Coaticoke, Que., have bought an M.P. 4-30 1050-125 volt generator for lighting purposes in their factory. The contract also includes the wiring of 350 16-c.p. lamps.

The Metropolitan Railway Co., of Toronto, which have now built their line to Newmarket, are said to have decided upon further extensions northward, for which the contracts will likely be let an early date.

Chief Buchanan, of the Winnipeg Fire Brigade, has submitted to the city council an estimate of the cost of a repairing plant. Using gasoline engines the cost is placed at $5,840, and using electric power, $5,340.

The council of Toronto Junction, Ont., are considering the question of increasing the municipal plant to such an extent as to furnish commercial lighting. It is estimated that this would entail an expenditure of $3,000.

Mr. Wm. Shaw, while showing a friend through the electric light works at Brandon, Man., accidentally walked into a large fly wheel revolving at a rapid speed. He was seriously injured and died a few days afterwards.

The Lachine Rapids Hydraulic & Land Company, of Montreal, are supplying to the Colonial Bleaching Company, of that city, induction motors aggregating 175 h.p., all of which are to be made by the Canadian General Electric Company.

The corporation of Prescott, acting under advice of their consulting engineer, have purchased their electric plant from the Canadian General Electric Company. This will consist of a 2,000-light 2,080-volt alternator with switchboard complete.

Plans have been prepared for the electric power transmission plant of the Kalamazoo Valley Electric Co., of Allegan, Mich. It is proposed to transmit the current, at a pressure of 40,000 volts, from Allegan to Jackson, a distance of 90 miles.

The Sutherland Improvement and Development Co., of New York, have deposited with the town council of Niagara Falls, Ont., a cheque for $1,000 in connection with the proposed conversion of the local street railway line to an electric system.

The Niagara Falls Park Commissioners have reached an agreement with the Fort Erie Electric Railway Company under which the latter agrees to extend its line for a distance of 13 miles along the bank of the Niagara river to Slater's Point.

The Dominion Steel & Iron Company, of Sydney, have placed their order with the Canadian General Electric Company for their electrical requirements. The initial plant will consist of two 125-k.w. 250-volt generators, with generator and feeder panels, and one 100 h.p. 250-volt motor.

The St. Thomas Gas Company, St. Thomas, Ont., have just finished the installation of a Brush arc dynamo having a capacity of 125 lamps. This machine embodies all the latest improvements in arc dynamo construction, and was purchased from the Canadian General Electric Company.

The council of Shelburne, Ont., recently submitted an offer to the Shelburne Electric Light Company to purchase their plant. This offer was refused, and as an arbitrator was not appointed by the company within thirty days thereafter, the council submitted a by-law to the ratepayers to authorize the purchase of a municipal lighting plant. The vote was taken on November 24th, and resulted in the defeat of the by-law by 32 votes.

The Niagara, St. Catharines and Toronto Railway Company have placed their order with the Canadian General Electric Co. for their entire motor equipment, consisting of six 4 motor and four 2 motor equipment. It will be remembered that this company has taken over the Niagara Central railway, with the intention of extending it ultimately to Toronto, and the Canadian General Electric Company is to be congratulated upon securing such an important order.

Mr. W. A. Turhayne, E.E., of Hamilton, has reported to the council of Woodstock, Ont., on the value of the plant of the Woodstock Electric Light Company, the taking over of which is under consideration by the council. He reports that $1,650 would be required for improvements, including $800 for reserve arc dynamo, $550 for lamps and weatherhoods, and $300 for alterations on line. To provide for an all night service a reserve engine and boiler would be required, at a cost of $3,200.

THE AUTOMOBILE.

It doesn't shy at papers
As they blow along the street ;
It cuts no silly capers
On the dashboard with its feet ;
It doesn't paw the sod up all around the hitching post,
It doesn't scare at shadows as a man would at a ghost ;
It doesn't gnaw the manger,
It doesn't waste the hay,
Nor put you into danger
When the brass bands play.

It makes no wild endeavor
To switch away the flies ;
It sheds no hair that ever
Gets in your mouth and eyes ;
It speeds along the highways and never looks around
For things that it may scare at and spill you on the ground !
It doesn't mind the circus,
It's not at all afraid ;
And it doesn't overwork us
When the elephants parade.

It doesn't rear and quiver
When the train goes rushing by ;
It doesn't stand and shiver
When the little snowflakes fly ;
It doesn't mind the thunder nor the lightning's blinding flash ;
It doesn't keep you chirping and connecting with the lash ;
It never minds the banners
They display on holidays,
It's a thing of proper manners,
Which it shows in many ways.

When you chance to pass its stable
You do not have to care
Or cluck for all your able
To keep from stopping there !
It will work all through the daytime and still be fresh at night,
There is no one to arrest you, if you do not treat it right !
Its wheezings ne'er distress you
As it moves along the way—
Farewell old Dobbins ; bless you !
You were all right in your day.

—Chicago Times Herald.

TRADE NOTES.

The corporation of Goderich, Ont., have accepted the tender of Sadler & Haworth, of Toronto, for supply of leather belting, at the price of $1.10 per foot for 13 inch and $2.95 per foot for 28 inch.

The Dominion Iron & Steel Co. has placed an order with the Robb Engineering Co. for two 150 horse power engines for electric lighting purposes. They have also recently bought from the Robb Co. a number of smaller engines and boilers for temporary use during the erection of their extensive plant.

The Goldie & McCulloch Co., Limited, Galt, Ont., continue to be busy in all their departments. As an indication of this we give a partial list of their shipments for the week ending November 25th.: Several large safes and vault doors, gas engines, 3 cars of flour mill machinery to different parts of the North-West, one car of same to Lucan, one carload of machinery, including boiler, etc., to Hamilton. There was also the usual amount of minor shipping.

The Macdonald Mfg. Co , of this city, will use in their new factory on Catharine street all the latest devices for the successful production of tinware, and among the rest they have decided to use electricity as a distributing medium in their power plant. They will use the Canadian General Electric Co.'s well known apparatus, consisting of a 60 k.w. direct connected generator and several motors of various sizes which will be either direct connected to the individual machines or to lines of shafting. The building will also be lighted throughout with incandescent lamps.

We were pleased to notice above the entrance to No. 30 Wellington street east, Toronto, a sign bearing the familiar name of "F. E. Dixon & Co". Enquiry elicited the fact that Mr. F. E. Dixon, who was for many years engaged in the manufacture of leather belting in Toronto, has resumed business in the same line. The firm have been appointed agents for Messrs. Morris & Co., manufacturers of leather and leather belting, London, Eng. (established 1775). Mr. Dixon reports that some of his old customers have already found their way back to him, and he hopes to see others in addition to many near ones.

The United Electric Co., Limited, of Toronto, report the following recent sales of motors : E. S. Stephenson & Co., St. John, N. B., four standard type motors ; Shaw, Cassels & Co., Bracebridge, Ont., one 40 h.p. multipolar motor ; Bertram & Sons, Dundas, Ont., two slow speed multipolar motors for direct gearing to large iron-working tools ; McLaren Manufacturing Co., Montreal, Que., one motor ; Oelschlager Bros., Berlin, Ont., one elevator motor ; Northey Manufacturing Co., Toronto, one standard motor ; Ryrie Bros., jewelers, Toronto, motors for operating their cash system ; Montmorency Cotton Mills Co., three standard motors for service in their mills at Montmorency Falls, Que.

MOONLIGHT SCHEDULE FOR DECEMBER.

Day of Month.	Light.	Extinguish.	No. of Hours.
	H. M.	H. M.	H. M.
1....	P.M. 5.00	A.M. 6.00	13.00
2....	" 5.00	" 6.00	13.00
3....	" 5.00	" 6.00	13.00
4....	" 5.00	" 6.00	13.00
5....	" 5.00	" 6.00	13.00
6....	" 6.00	" 6.00	12.00
7....	" 7.50	" 6.00	10.10
8....	" 10.00	" 6.00	8.00
9....	" 11.00	" 6.10	7.10
10....	" 11.10	" 6.10	7.00
11....	....	" 6.10	5.50
12....	A.M. 12.20	....	
13....	" 1.30	" 6.10	4.40
14....	" 2.40	" 6.10	3.30
15....	No Light.	No Light.	.....
16....	No Light.	No Light.	.....
17 ...	No Light.	No Light.	.....
18....	P.M. 5.00	P.M. 9.20	4.20
19....	" 5.00	" 9.20	4.20
20....	" 5.00	" 9.20	4.20
21....	" 5.00	A.M. 2.30	9.30
22....	" 5.00	" 2.30	9.30
23....	" 5.00	" 2.30	9.30
24....	" 5.00	" 2.30	9.30
25....	" 5.00	" 2.30	9.30
26....	" 5.10	" 2.10	9.00
27....	" 5.10	" 3.10	10.00
28....	" 5.10	" 4.20	11.10
29....	" 5.10	" 5.20	12.10
30....	" 5.10	" 6.20	13.10
31....	" 5.10	" 6.20	13.10
		Total.........	252.30
		Grand Total...	2,196.40

The Hamilton Steel & Iron Company have placed a contract with the Canadian General Electric Company for a direct-connected 75-k.w. 250-volt generator for operating their electric cranes.

A company of Canadian capitalists has been formed to construct and operate an electric railway system at Georgetown, Demarara, West Indies. Sir Wm. Van Horne is president of the company, and Mr. W. B. Chapman, of Montreal, an active director.

SPARKS.

The Ottawa Electric Co. are installing a storage battery equipment to regulate the current on power circuits.

The Lake Megantic Electric Company are replacing their 30 k.w. alternator with one of 60 k.w. output. The Canadian Electric Company have the contract.

The Chambers Electric Co., of Truro, N.S., are installing another 55 k.w. multipolar generator of the Canadian General Electric Company's make.

The Palmerston Carriage Co., of Palmerston, Ont., are installing in their factory an electric light plant, furnished by the Royal Electric Company.

The Stanstead Electric Light Company, of Stanstead, Que., have lately made improvements to their plant, putting in new armatures and changing the voltage from 1,000 to 2,000 volts.

The Berlin Rubber Co., of Berlin, Out., are installing a 17 k.w. direct current 125 volt generator in their factory for lighting purposes. The order has been given to the Canadian General Electric Co.

The Winnipeg Street Railway Company are installing another 150 k.w. monocyclic generator with panel, to supplement those already in use. The order was placed with the Canadian General Electric Company.

The Consnmers Cordage Company, of Dartmouth, N. S., are installing a multipolar 6-30-125 volt generator of the Canadian General Electric Co.'s make, which will be driven by a Robb-Armstrong engine.

The Canada Electric Co., of Amherst, N.S , whose generating plant was recently destroyed by fire, has purchased two direct current 55 k.w. multipolar generators and switchboard from the Canadian General Electric Co.

It is pleasing to note the increase of power business in connection with alternating lighting plants, especially when monocyclic machines of the Canadian General Electric Company are in use. The Hanover Electric Light Company are just putting on another 20 h.p. induction motor.

The capital stock of the Electrical Maintenance and Construction Co., of Toronto, is about to be increased from $20,000 to $250,000. This step has been rendered necessary by the unexpectedly large amount of business which has come to the company since its organization last year. They are understood to have now in hand contracts amounting to $100,000.

A serious but peculiar accident occurred at Point St. Charles, Que., by which Geo. Pierce was instantly killed. Deceased was pressing ashes into a cylinder, holding in his hand a long iron pole which he was using. The pole met an obstruction, causing him to raise it up quickly, thus breaking the globe on an arc light above his head and forming a circuit, by means of which the current passed into his body, death resulting immediately.

The corporation of Weston, Ont., have placed a contract with the Canadian General Electric Company for a complete lighting plant for the town. They will use alternating arc lamps for street lighting, and the generating plant will consist of a standard 30 k.w. alternator and switchboard operated by an Ideal engine.

The premises of the Toronto Carpet Mfg. Co., of Toronto, are now lighted by electricity. The Canadian General Electric Company have just completed the work of installation, which included the supplying of a steel frame 55 k.w. generator with switchboard, and the wiring up of about 300 16 c.p. lamps.

The Helois Company of Colonge, Germany, will begin early next year to erect a large plant in the province of Posen, for the distribution of electricity for lighting and power purposes over an extensive agricultural district. The distributing mains will extend for a distance of 15 miles around the station. Not only is it intended to supply current for lighting purposes and operating dairy machinery, but also for driving agricultural implements, such as threshing machines, plows and chaff cutters. It is estimated that the undertaking will cost about $1,300,000. The Helois Company have already made arrangements with land owners in the district in which the plant is to be erected for the annual plowing of their land. For this purpose 40 plowing machines will have to be provided, and the work must be done, according to agreement, between July 15 and Dec. 1 every year.

PUBLICATIONS.

A neat catalogue of Lundell generators, direct connected and belted types, is to hand from Messrs. Jack & Robertson, of Montreal, sole agent for Canada of the Sprague Electric Co., of New York. The split pole machines are the latest and most modern construction for these generators. The booklet contains numerous tables and diagram showing regulation and efficiency curves.

The Official Messenger is the title of a booklet to be issued monthly by the Colliery Engineer Company proprietors of the International Correspondence Schools, of Scranton Pa. It is intended to serve as a medium of communication from the home office to the staff of solicitors, collectors and assistant superintendents. The initial number is beautifully illustrated, and is devoted to a detailed account of the gradual evolution of the International system, a description of the building, method of instruction and the business relations of the home office with the men in the field. The editor is Mr. Geo. F. Lord.

The Maritime Newspaper Company, of Halifax, N.S., publishers of the Industrial Advocate, in their special supplement devoted to the city of Halifax, have issued a most commendable number, and one which is indicative of the progressive spirit of the publishers. The supplement is profusely illustrated and includes carefully written articles bearing upon the industries of Halifax. Among these is a description of the street railway system of that city as operated by the Halifax Electric Tramway Company. This is accompanied by an illustration of the offices of the company and by portraits of the officers. The advertising patronage bestowed upon the number is an evidence that the public have confidence in the publishers.

SPARKS.

Mr. R. J. Holley has been appointed electrician of the electric light plant installed by the town of Weston, Ont.

It is understood to be the intention of the authorities of Kingston penitentiary to install a new electric light plant in the building.

It is understood that the power house of the Niagara Falls Park & River Railway, at Niagara Falls, Ont., which was burned recently, will be rebuilt.

The feasibility of building an electric railway between Rossland and Trail, B.C., is receiving consideration, Col. Topping being a strong advocate of the project.

Mr. V. M. Roberts, C.E., of Niagara Falls, Ont., is understood to have been engaged by an English syndicate to report on the water powers of the Sturgeon river.

John Sheffield, an electrician employed by the Union Carbide Works, Niagara Falls, N.Y., and a native of Kingston, Ont., was killed by falling against the primary terminals of a switch.

It is proposed to establish in Hamilton a motor vehicle stable, where automobiles will be taken care of and recharged.

It is expected that the Keewatin Power Co. will proceed to further develop their water power at Norman, Ont., next year.

The town of St. Paul, Que., will ask authority from the provincial legislature to construct and operate an electric railway to connect with St. Henri and Montreal.

Mr. J. B. Charleson, who superintended the construction of 740 miles of telegraph line from Bennett to Dawson City, states that the line cost $137,000, or about $290 per mile. Before proceeding with the work, he says, the C.P.R. and the G. N. W. companies were asked what it would cost and the figures given were $350 and $400 per mile respectively.

A telephone cable across the St. Lawrence river between Prescott, Ont., and Ogdensburg, N. Y., was completed by the Bell Telephone Company last month. The cable, which was made by the Safety Submarine Company, of New York, is one and one-quarter miles long, one and one-half inches in diameter, and weighs 14,000 pounds. The work was executed under the superintendence of W. H. Winter.

The Owen Sound Electric & Illuminating Co., of Owen Sound, Ont., are installing a 65-light dynamo of the latest pattern. The new machine will be placed in the water power station. The two dynamos, including the newly repaired street circuit dynamo, will then be placed in the steam power house, which will thus give the company a duplicate plant to meet any emergency, besides making it possible to supply electric power as soon as the industrial development of the town demands it. The company have installed a plant in factory A of the North American Bent Chair Co., and are about to extend it to factory B, to supply both light and power.

California miners are putting in extensive apparatus at the Consolidated Cariboo Hydraulic Mining Co.'s property, near Quesnelle Forks, B.C. Two lines of sluices, 7 feet wide, were placed in the bed of the gulch, paved with steel riffles, weighing in the aggregate 79 tons. A canal 7 by 13 feet, 10 miles long, was commenced in June and completed November 15, 1899. A dam 485 feet long on top and 50 feet high was constructed across the outlet of a lake at the head of the canal for storage of about 550,000,000 cubic feet of water. The construction of this dam and the canal furnished employment for 350 men and 120 horses, and cost $125,000. About 75,000 pounds of dynamite, 75,000 pounds of black blasting powder and 100,000 pounds of other miscellaneous mining supplies are used annually at the mine, which has now completed thirty-three miles of canals and three storage reservoirs having a total area of 2,184 acres and a storage capacity of 1,016,000,000 cubic feet of water.

SPARKS.

The Toronto Street Railway Company are now extending their line into the town of Toronto Junction.

The Kinney-Haley Manufacturing Company are installing an electric light plant in their works at Yarmouth, N.S.

The town of Gorrie, Ont., is to be lighted from the plant sold by the United Electric Co. to the Wroxeter Electric Light Co.

The council of Midland, Ont., is negotiating with the Midland Electric Light Co. for the renewal of the contract for street lighting.

Mr. F. C. Coffin, M.E., of Boston, has been engaged to prepare plans and specifications for a steam pumping plant for the town of Yarmouth, N.S.

It is proposed to submit a by-law to the ratepayers of Parkhill, Ont., to raise a sum of money to establish an electric light plant and waterworks system.

The Stormount Electric Light Co., of Cornwall, Ont., has installed a new 2,000-light dynamo, furnished by the Canadian General Electric Company.

A recent report from Morden, Man., states that the council will probably lease the electric light plant there for one year, with the privilege of purchase at the end of that period.

John Harrison & Co.'s new factory at Owen Sound, Ont., is being wired electrically, the company having given a five years' lighting contract to the Owen Sound Electric & Illuminating Co.

The Waterloo Electric Light & Power Company have decided to thoroughly overhaul their plant. The three machines at present in use will be replaced by a 60 k.w. multipolar generator.

Mr. S. F. Ritchie, of Aylmer, Que., has purchased a mining property near Eardley, and it is probable that an electric plant will be installed for operating the mine, power to be obtained from a stream near by.

The acetylene gas plant in the post office at Fort Steel, B.C., exploded on November 19th, severely injuring the post master and his assistants. The accident resulted while searching for a leak with a lighted match.

Telephonic communication has just been completed between the lighthouse on Belle Isle, situated 600 feet above the sea, and the power house, near the sea level, two miles distant on the southwest extremity of the island.

An automobile contest is to be one of the features of the Paris Exhibition. One hundred thousand francs will be expended on the construction of a track and grand stands at Vincennes, where a charging station will also be provided.

The United Electric Co., Toronto, have been requested by the South African Mutual Life Assurance Co., of Cape Town, to submit price to them for two direct connected units and system of accumulators for power and light for their new office building in Port Elizabeth, South Africa.

The United Electric Company, Limited, Toronto, have recently sold their improved arc lamps to the Niagara Falls Electric Co., Colborne Electric Light Co., the Harriston Pork Packing Co., Dominion Bridge Co., Montreal, the Owen Sound Electric Illuminating & Manufacturing Co., Shaw, Cassils & Co., Bracebridge, and others.

Low & Farrell, of Hamilton, have brought suit against Chas. Hardy, A. L. Pentecost and Wm. Stewart to recover an account of $300 for the electric wiring of the Pentecost store. The action was primarily against the landlord, Mr. Hardy, but the tenant and architect were brought into it as co-defendants. Mr. Hardy claimed that the plaintiffs exceeded their orders in the work, having put in both electric light and gas when only gas was ordered. The architect states that it was necessary to have electric lighting in part of the store, and the cost was no more than it would have been with gas alone. Judgment has been reserved.

The Quebec Railway, Light & Power Co. has taken an action to compel the Jacques Cartier Water Power Co. to remove the poles that the latter have placed on the city streets. The plaintiff alleges that the defendant company is incorporated in the State of New Jersey, but that it has no power to supply electricity in the city or district of Quebec; further, that the high voltage of the wires which will cross and intersect the established electric wires will be a menace to the lives of the employees of the plaintiff and a public danger. It is asked that the defendant be enjoined perpetually from interfering with the electric wires of plaintiff, and compelled to remove the poles within fifteen days, or that the court authorize the plaintiff to remove said poles and to charge the defendant with the cost.

It would appear from data now in our possession, says the Electrical World, that in Europe there are now well over 7,000 owners of automobiles. Many of these own more than one vehicle, so that perhaps the number of vehicles could be put at 10,000. Of the 7,000, no fewer than 5,600 are in France. The general idea has been that in France the interest was centred in Paris, but this is erroneous, there being of the 5,600 no fewer than 4,541 scattered all through the departments. In France, moreover, there are 619 manufacturers of automobiles, not including makers of detail parts, 998 dealers in them, 1,095 repair shops, 3,939 stores for oil, gas, etc., and 265 electric charging plants and "posts." For the remainder of Europe the figures are far from complete, but it would appear that there are 268 owners of automobiles in Germany, 90 in Austro-Hungary, 90 in Belgium, 44 in Spain, 304 in Great Britain, 111 in Italy, 68 in Holland, 114 in Switzerland, and 35 in Russia, Denmark, Portugal, etc.

SPARKS.

The West Kootenay Power & Light Co., of Rossland, B. C. will probably increase its stock from $1,000,000 to $2,000,000.

Mr. McIntosh has submitted a proposition to the municipal council of Greenwood, B. C., to establish an electric tramway to Phoenix and an electric light plant.

Mr. C. B. Hunt, manager of the London Electric Co., presented gold fountain pens to Messrs. Wm. Adams and Chester McLaren, members of the London company of the South African contingent who were employed by Mr. Hunt.

The electric light plant at Niagara Falls, Ont., was taken over by the corporation on November 1st.

Mr. D. J. Kennedy has made application to the council of Sydney, C. B., for a franchise for a street railway.

The Ottawa Street Railway Company have ordered from the Ottawa Car Company four new open cars for the Brittannia line. These will be fifty feet long, with an aisle down the centre and fourteen benches an either side of the aisle. The railway company have purchased twelve acres of land at Britainnia for park purposes.

A fire alarm system will probably be installed in the town of Woodstock this winter.

Mr. Cooke, of St. Catharines, Ont., has ordered a new water wheel and additional equipment for his power station.

A fire alarm system has been installed for the corporation of Harriston, Ont., by the United Electric Company, Toronto.

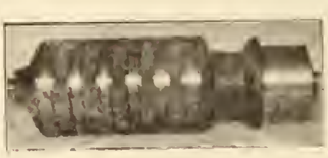
The council of Thamesville, Ont., has decided to take a vote of the ratepayers on the question of purchasing an electric light plant.

At the municipal elections in January the ratepayers of Pembroke, Ont., will vote on a by-law to a raise $30,000 to purchase a municipal electric light plant

The United Electric Company, of Toronto, announce the following sales of lighting plants : D. W. Karn & Co., organ manufacturers, Woodstook, Ont., a complete 400 light incandescent plant ; Goderich Organ Co., 100 light dynamo ; Peter Hay, Galt, Ont., incandescent lighting plant ; Wroxeter Electric Light Co., 25 k.w. inductor alternator complete with swichboard ; Henry Cook, Hensall, Ont., 45 k.w, inductor alternator, and two direct current generatois to be used for furnishiug light and power in the town of Zurich, Ont.; Harriston Pork Packing Company, Harriston, Ont., complete arc and incandescent lighting plant ; Louisville Shirt Manufacturing Co., Louisville, Que., incandescent lighting plant ; Board of Trade, Toronto, incandescent dynamo ; town of Mitchell, Ont., direct current incandescent dynamo ; Waterloo Elecuic Light Co., Waterloo, Ont., 60 k.w. 250 volt multipolar generator ; A. Burritt & Co., Mitchell, Ont., incandescent dynamo for lighting their mills ; Guest and Stead, Pattenham, Ont., incandescent dynamo ; A. H. Ingram, Seaforth, Ont., 100 light dynamo ; Globe File Co., Port Hope, Ont., complete incandescent lighting plant for their new factory.

Photograph of a Chimney BEFORE the American Stoker was installed.

The same Chimney AFTER THE ... American stoker was installed.



55-INCH CROCKER TURBINE FOR BOSTON RUBBER CO., ST. JEROME, QUE.